



Applying Psychological Science to Teaching and Learning

Conor T. McLennan

Cognitive Psychology



- Retrieval practice (testing)
- Desirable difficulties
- Elaboration - meaning, self
- Distributed practice
- More...

Cognitive Psychology



- “Despite all the gains made in understanding what happens when people learn, the truth is that most professors have gained relatively little from **cognitive psychology**.”

Diane Halpern (2002). New Directions for Higher Education, pp. 41-43

Cognitive Psychology



- University of Memphis

[25 Learning Principles](#) to Guide Pedagogy

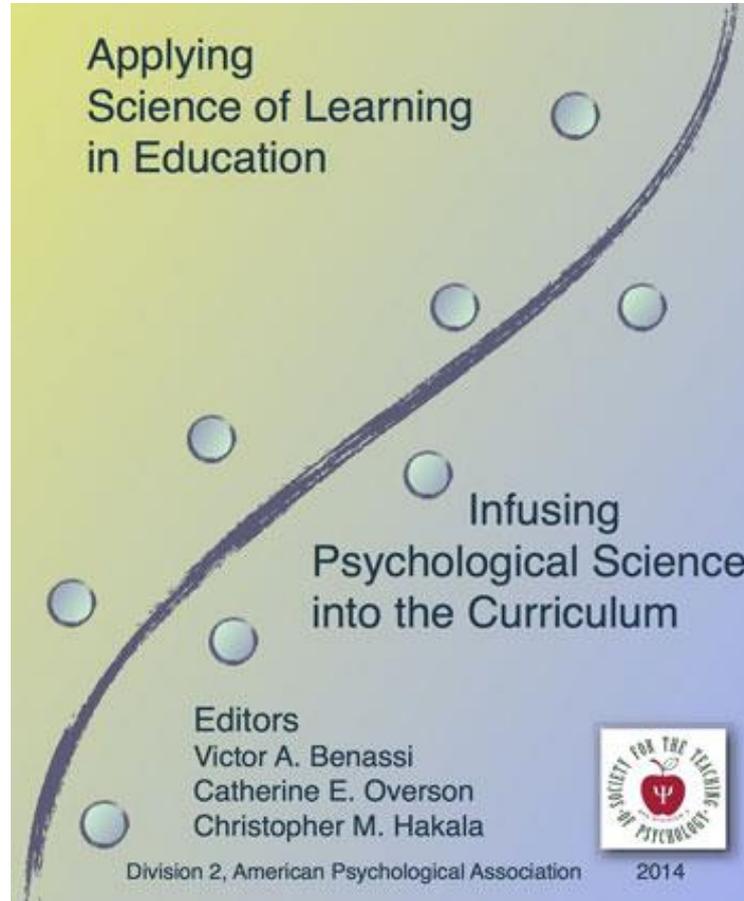
- University of New Hampshire

[Cognition Toolbox](#)



Society for the Teaching of Psychology

Division 2 of the [American Psychological Association](#)



Applying Cognitive Psychology to Education: Translational Educational Science

Henry L. Roediger, III

Washington University in St. Louis



Psychological Science in the
Public Interest
14(1) 1–3

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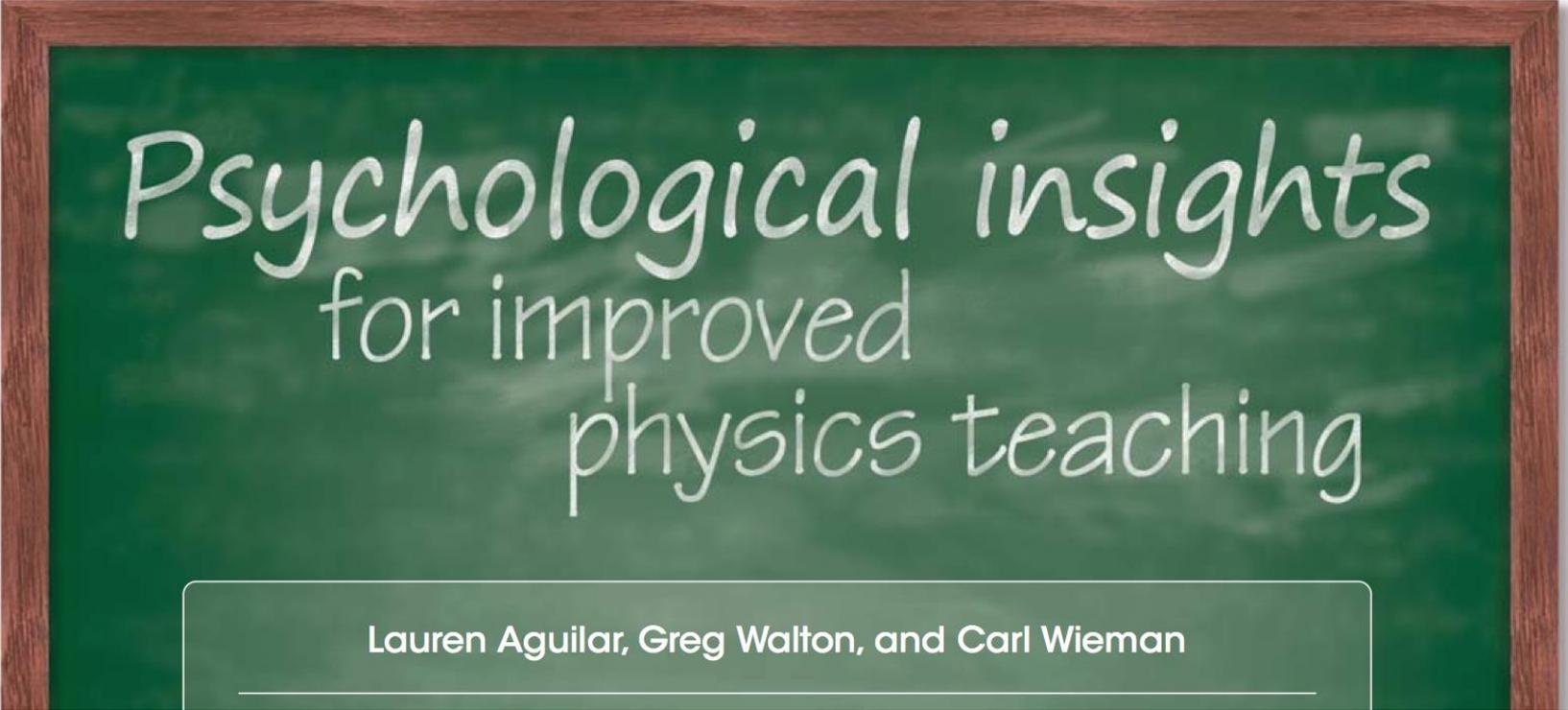
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*Psychological insights
for improved
physics teaching*

Lauren Aguilar, Greg Walton, and Carl Wieman



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TEACHER-READY RESEARCH REVIEW

Practice Tests, Spaced Practice, and Successive Relearning: Tips for Classroom Use and for Guiding Students' Learning

John Dunlosky and Katherine A. Rawson
Kent State University

Dunlosky and Rawson (2015)



- “We applaud teachers who continue to search for the best ways to present difficult-to-grasp concepts” (p. 72).

Clickers



- Can be implemented in a way that capitalizes on what we know – *from research in cognitive psychology* - about effective teaching and learning
- Many advantages



March 2, 2009

All Tech Considered

In

by D



Re: for tech clas

College of Science – Cleveland State University

Psychology Assistant Professor, Dr. Conor McLennan, was recently featured on FOX 8 news in a story on the beneficial uses of clickers in the classroom!



Parenting U: Clicker in the Classroom

fox8.com

How many times have you used a clicker today? Your kids may have used it several times in class. Fox 8's Todd Meany explains.

Like · Comment · Share · about an hour ago ·



Michael Horvath and Andrea Hasselbusch like this.



Andrea Hasselbusch Very cool! Go Dr. McLeannan! Loved his Cognitive Pscyh class!

3 minutes ago · Like

Write a comment...



Dan Bobkoff for NPR

Students in professor Conor McLennan's class at Cleveland State University use clickers almost as much as a pen.

Perhaps Psychology 372 isn't really as dramatic as *Who Wants to Be a Millionaire*, but the students did seem engaged. In fact, McLennan polled his class — with the clickers, of course — and found that 96 percent of them really like using them. By constantly polling, McLennan gets an instant read on how much of the material the students are absorbing.

"I thought people would be less likely to speak up because now they can respond anonymously, they don't have to open their mouth," McLennan says. "But it turns out, it's the other way around.

Active Learning



- *“Tell me and I forget, teach me and I remember, involve me and I learn.”* Benjamin Franklin
- Many ways to do this
- Clickers are one way

Memory Tests



- Get a pen and paper ready
- Don't write until instructed



Test 1

Test 1



bed	doze
rest	slumber
awake	snore
tired	nap
dream	peace
wake	yawn
snooze	drowsy
blanket	



Write down all of the words



Test 2

Test 2



thread	haystack
pin	thorn
eye	hurt
sewing	injection
sharp	syringe
point	cloth
prick	knitting
thimble	



Write down all of the words



Get your clickers ready ...

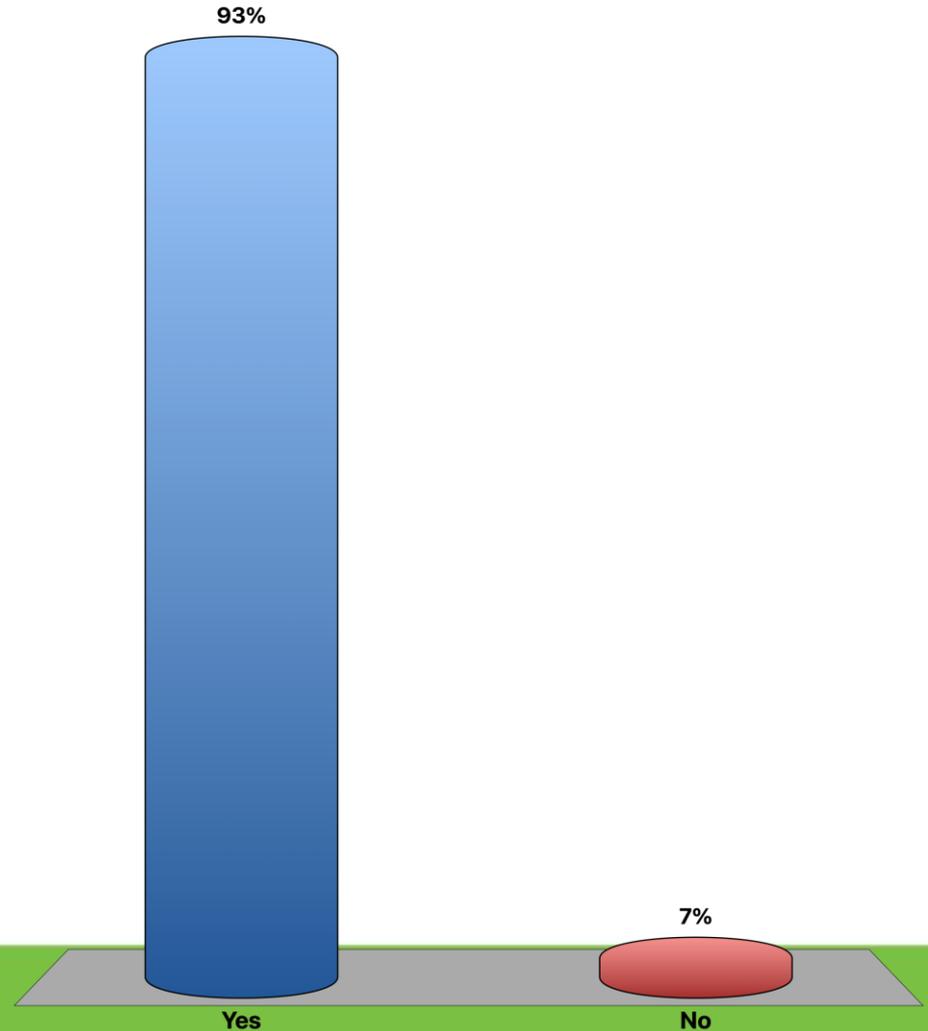
Test 1

Did you write down bed?



A. Yes

B. No

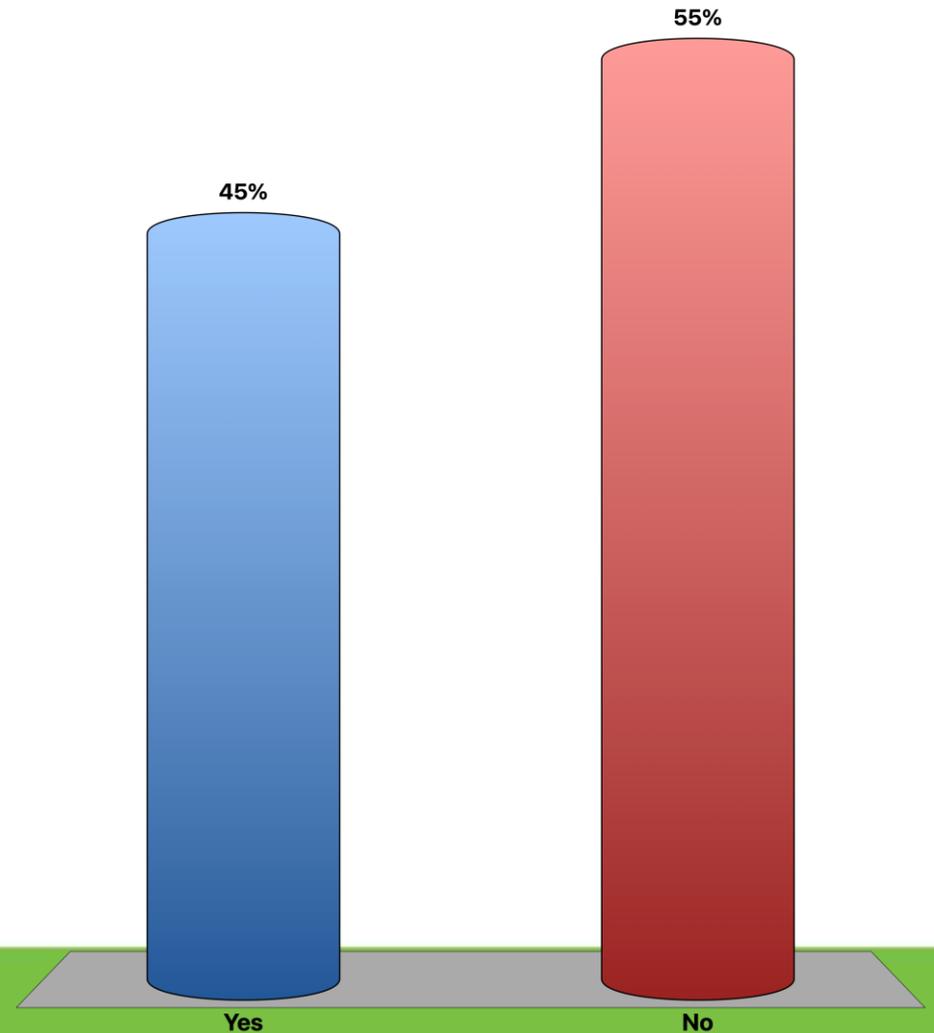


Did you write down tired?



A. Yes

B. No

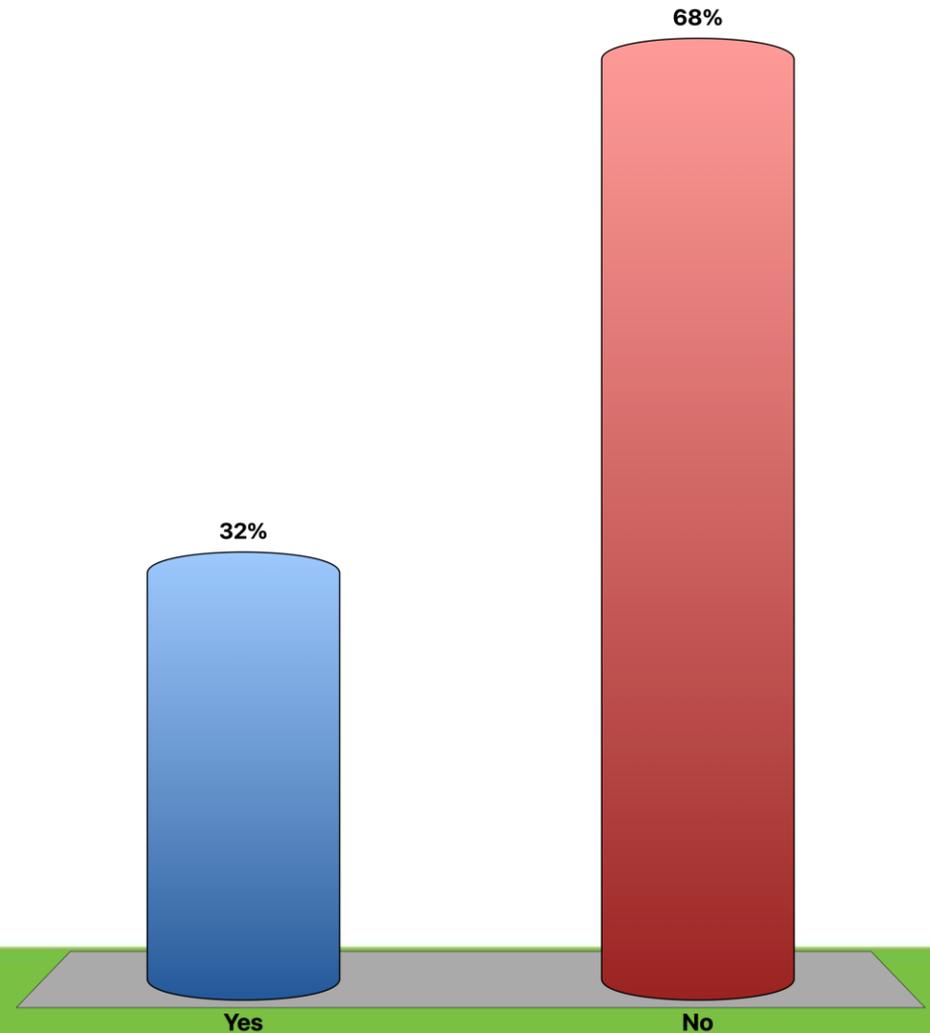


Did you write down sleep?



A. Yes

B. No





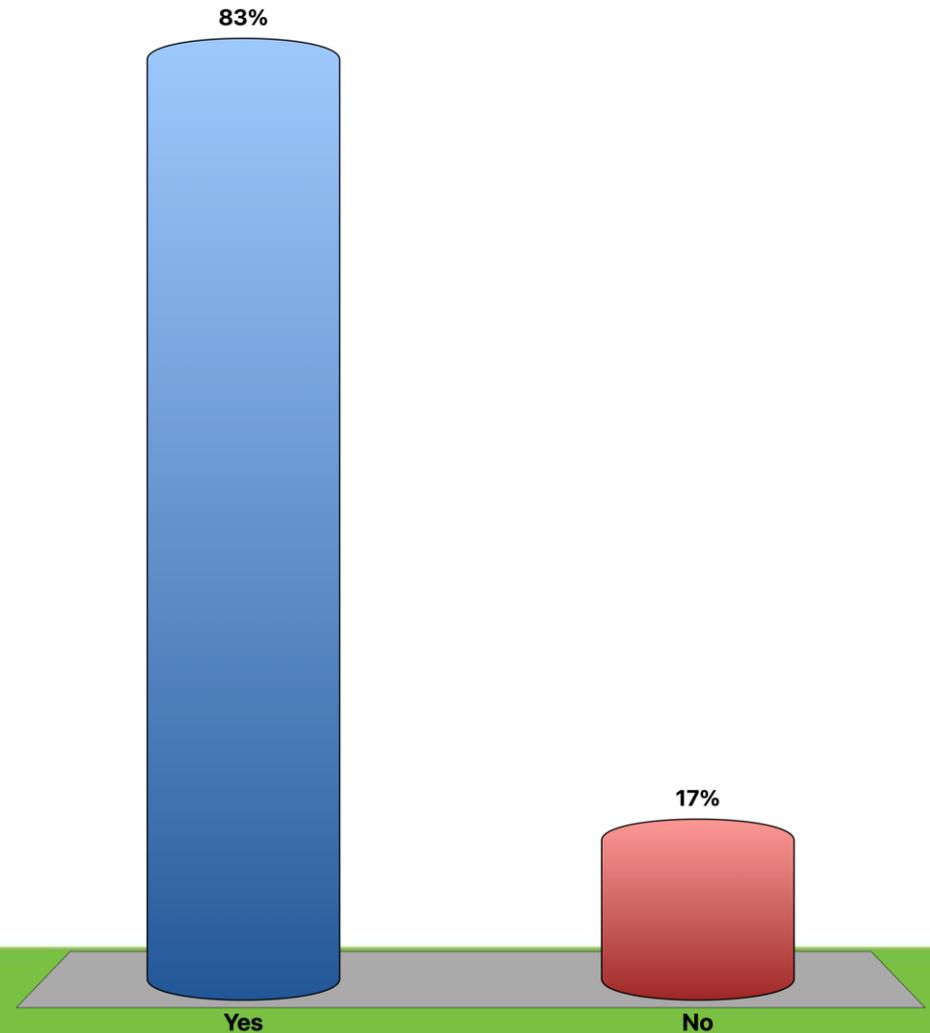
Get your clickers ready ...

Test 2

Did you write down thread?



- A. Yes
- B. No

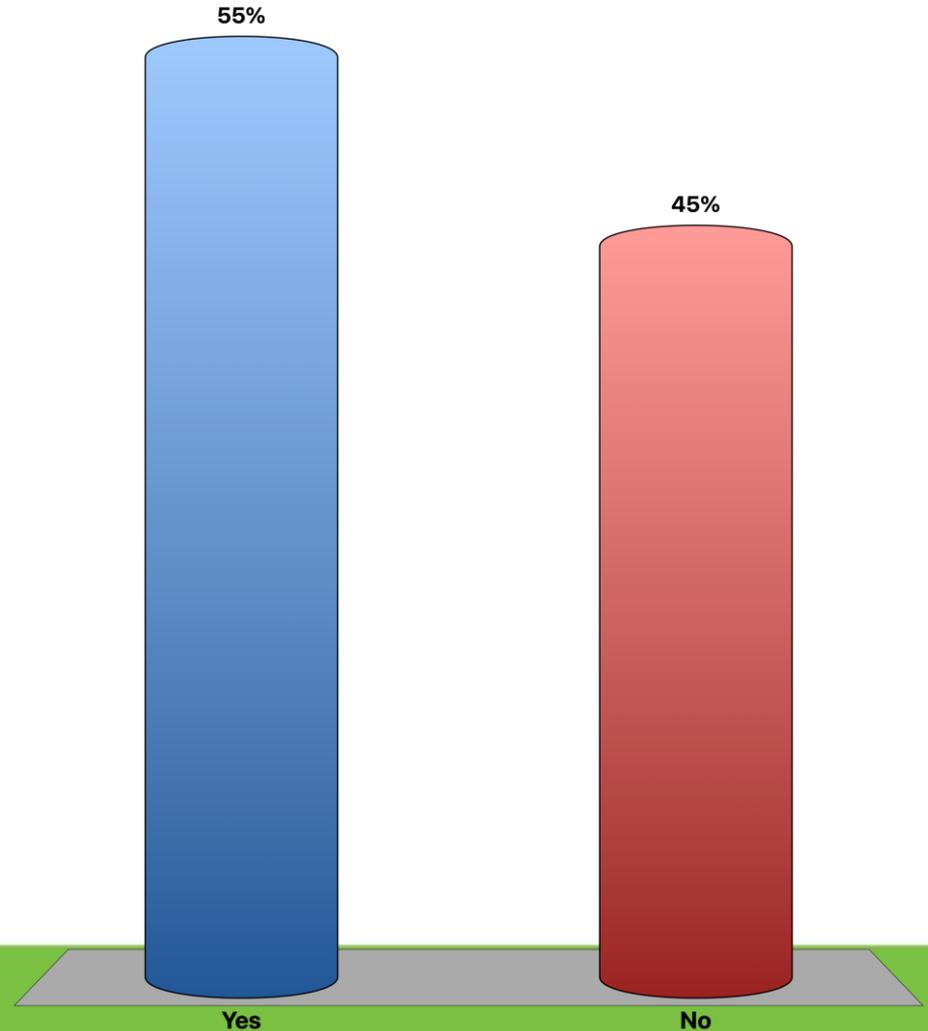


Did you write down pin?



A. Yes

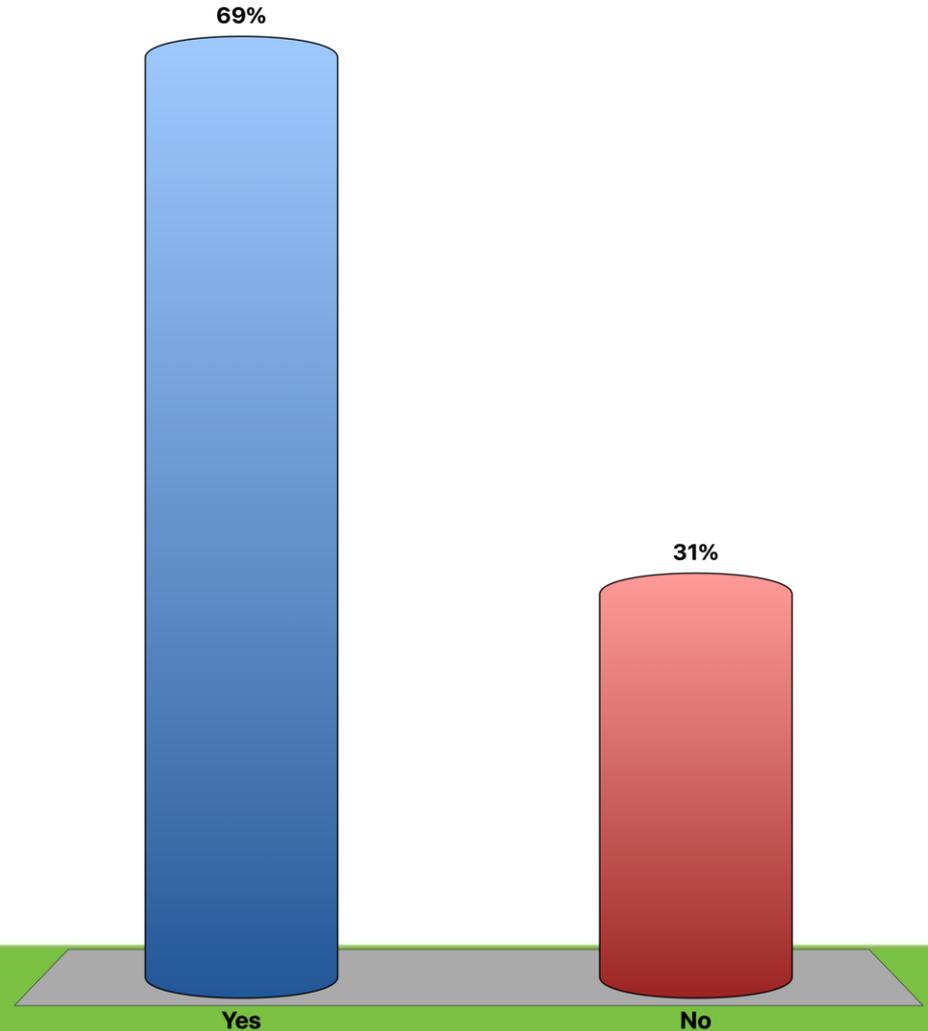
B. No



Did you write down needle?



- A. Yes
- B. No





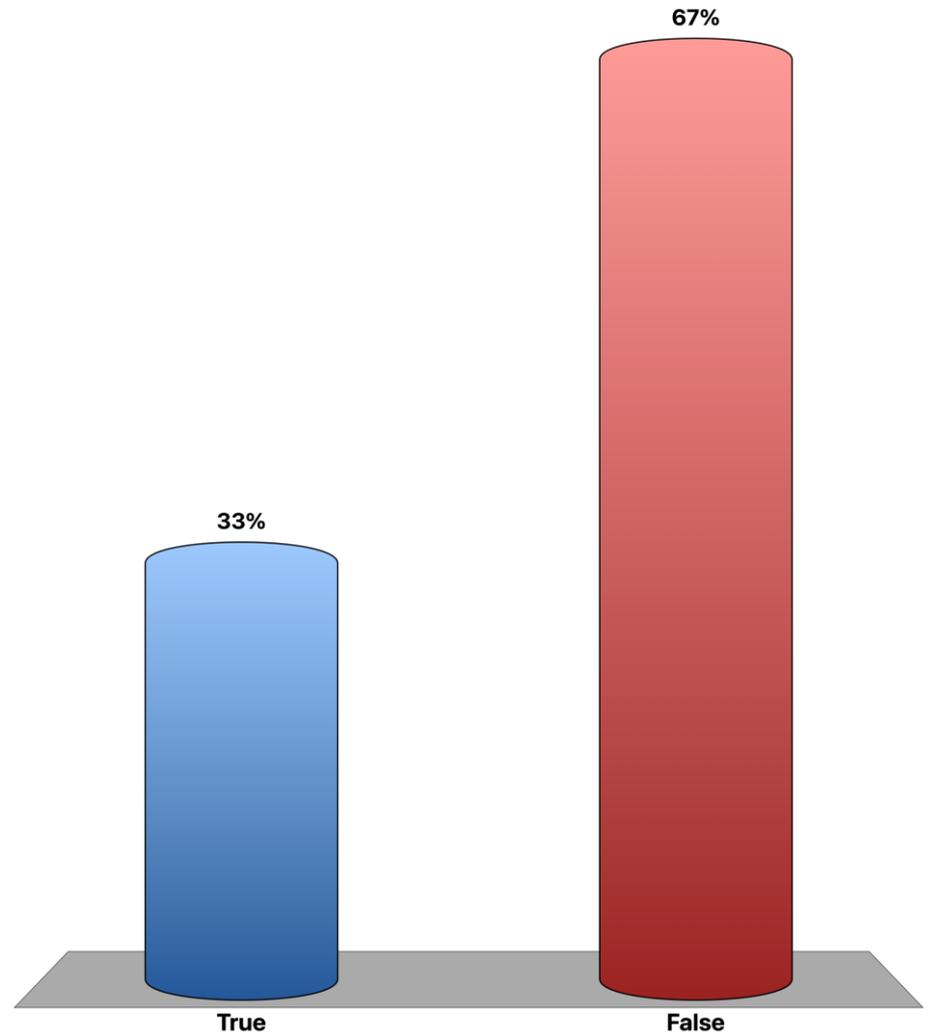
False Memory



Few more clicker questions ...

People only use about 10% of their brain.

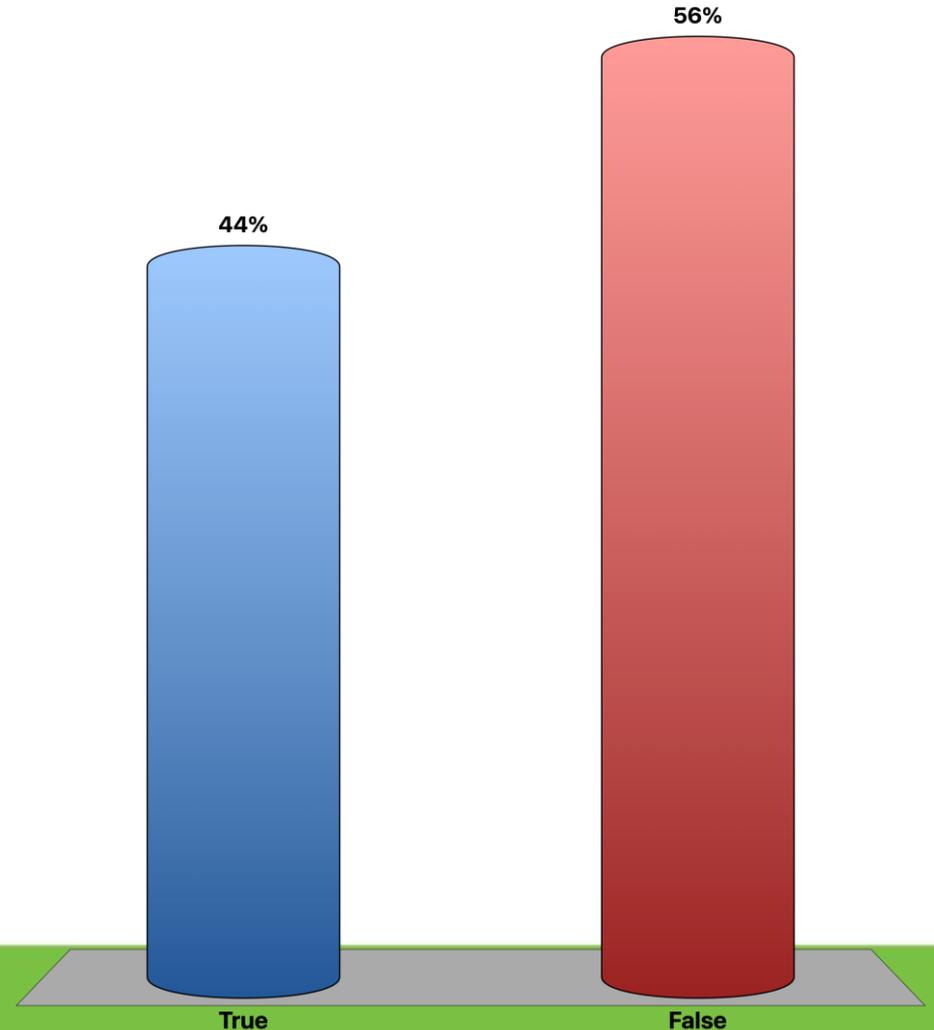
- A. True
- B. False



Some people are left-brained, others are right-brained.

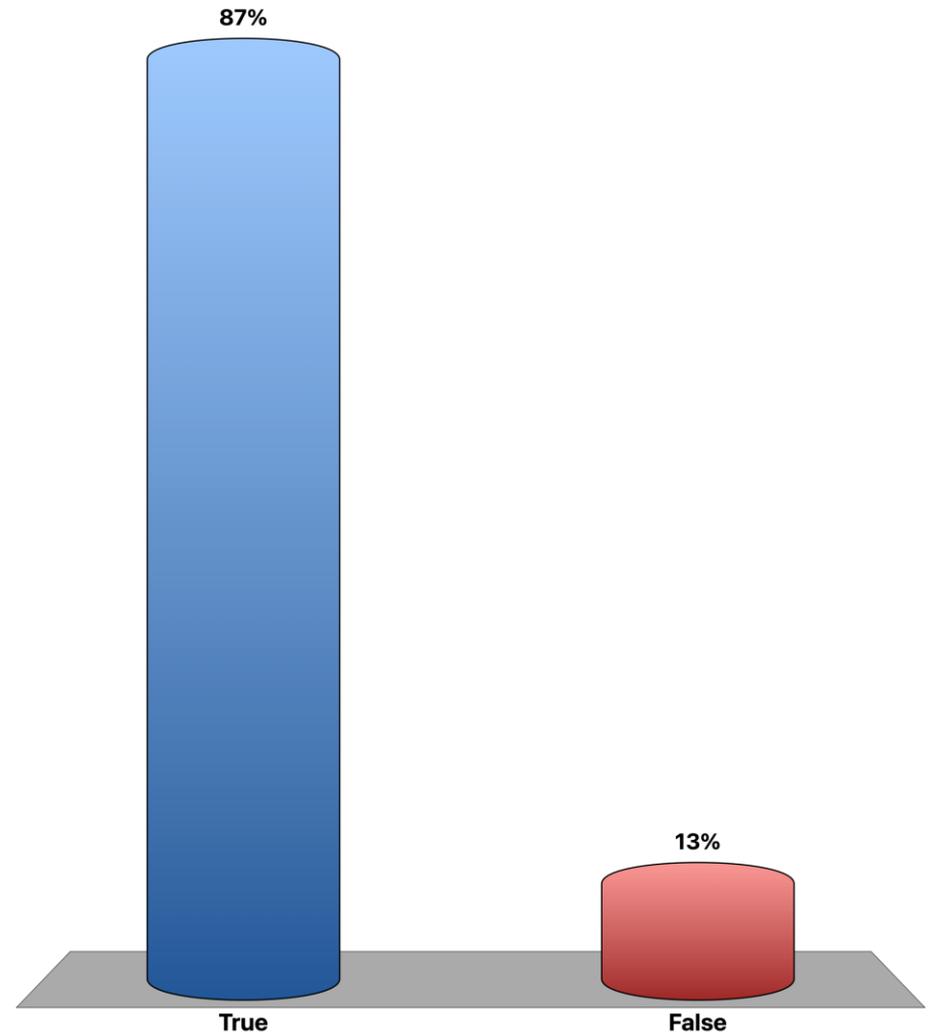


- A. True
- B. False



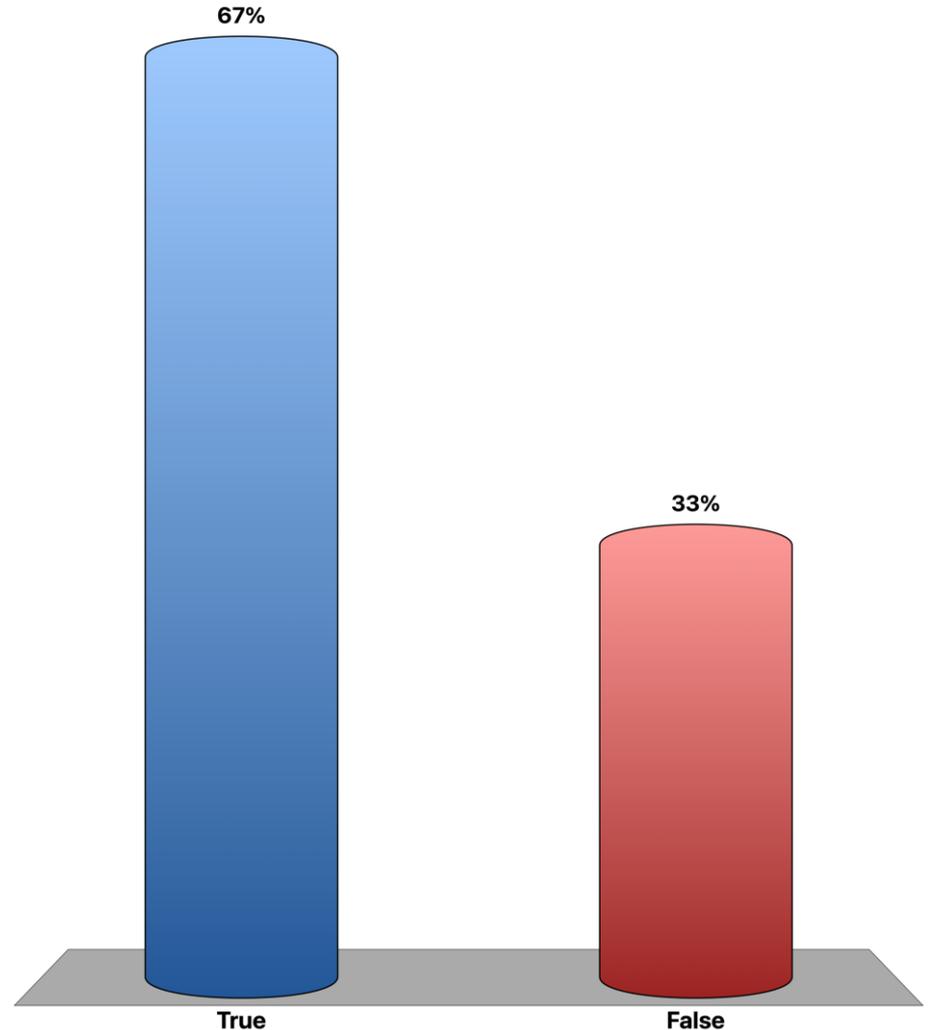
Subliminal messages can persuade people to purchase products.

- A. True
- B. False



Teaching to a student's preferred learning style (for example – auditory or visual) leads to better learning outcomes.

- A. True
- B. False



Myths



50 GREAT MYTHS OF POPULAR PSYCHOLOGY

**Shattering Widespread
Misconceptions about
Human Behavior**

Scott O. Lilienfeld
Steven Jay Lynn | John Ruscio
Barry L. Beyerstein

WILEY-BLACKWELL

npr

k-12

“ Getting people to think about what they think, and asking them questions about it, is the best way I know how to teach.

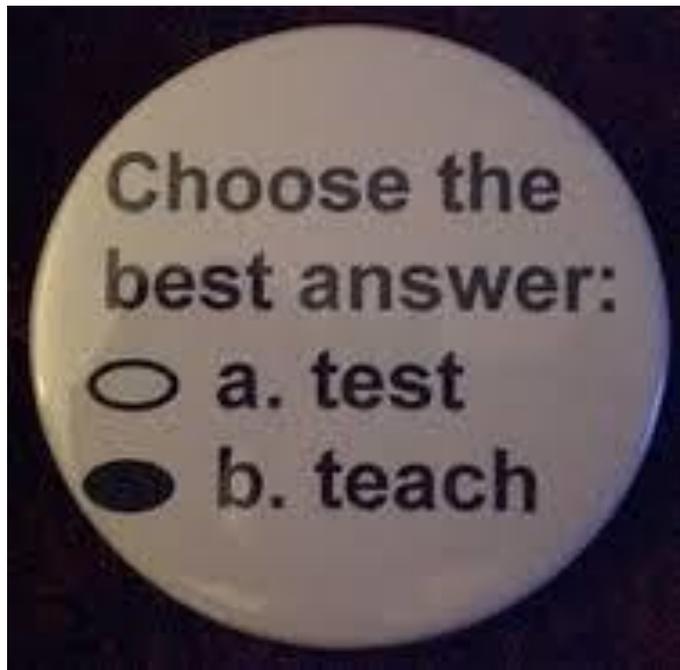
5 Great

teacher

November 01

- *Eleanor Duckworth*

Eleanor Duckworth is a research professor at the Harvard Graduate School of Education





- Dr. Roediger's Keynote [Address](#)
 - Psychonomic Society
 - *The Critical Role of Retrieval in Enhancing Long-Term Memory: From the Laboratory to the Classroom*





- Dr. Roediger's Keynote Address
 - Psychonomic Society

“Repeated retrieval is the key to long-term retention.”

*“Beyond some minimal amount, **repeated studying does not much matter.**”*





- Dr. Roediger's Keynote Address
 - Psychonomic Society

“Testing enhances learning: Students engage in retrieval processes, practicing the skill needed to access information in the long term.”

“Self-testing should be incorporated into students' study strategies.”



KEEP
CALM
AND
CONTINUE
TESTING

Research Article

Test-Enhanced Learning

Taking Memory Tests Improves Long-Term Retention

Henry L. Roediger, III, and Jeffrey D. Karpicke

Washington University in St. Louis

prior testing produced substantially greater retention than studying, even though repeated studying increased students' confidence in their ability to remember the material. Testing is a powerful means of improving learning, not just assessing it.

The Power of Testing Memory

Basic Research and Implications for Educational Practice

Henry L. Roediger, III, and Jeffrey D. Karpicke

Washington University in St. Louis

*Frequent testing in the
classroom may boost educational achievement at all levels
of education.*

Test-Enhanced Learning in a Middle School Science Classroom: The Effects of Quiz Frequency and Placement

Mark A. McDaniel and Pooja K. Agarwal
Washington University in St. Louis

Barbie J. Huelser
Columbia University

Kathleen B. McDermott and Henry L. Roediger, III
Washington University in St. Louis

Quizzing produced significant learning benefits

The benefits of quizzing (relative to not quizzing) persisted on cumulative semester and end-of-year exams. We suggest that the present effects reflect benefits accruing to retrieval practice, benefits that are well established in the basic literature.

the cross-cutting edge

Test-enhanced learning in medical education

Douglas P Larsen,¹ Andrew C Butler² & Henry L Roediger III²

© Blackwell Publishing Ltd 2008. MEDICAL EDUCATION 2008; **42**: 959–966



ORIGINAL ARTICLE

The effect of repeated testing vs repeated practice on skills learning in undergraduate dental education

S. Sennhenn-Kirchner , Y. Goerlich, B. Kirchner, M. Notbohm,
S. Schiekirka, A. Simmenroth, T. Raupach

First published: 24 January 2017 [Full publication history](#)

Rethinking the Use of Tests: A Meta-Analysis of Practice Testing

Olusola O. Adesope

Washington State University

Dominic A. Trevisan

Simon Fraser University, Canada

Narayankripa Sundararajan

Washington State University



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The testing effect is a well-known concept referring to gains in learning and retention that can occur when students take a practice test on studied material before taking a final test on the same material. Research demonstrates that students who take practice tests often outperform students in nontesting learning conditions such as restudying, practice, filler activities, or no presentation of the material. However, evidence-based meta-analysis is needed to develop a comprehensive understanding of the conditions under which practice tests enhance or inhibit learning. This meta-analysis fills this gap by examining the effects of practice tests versus nontesting learning conditions. Results reveal that practice tests are more beneficial for learning than restudying and all other comparison conditions. Mean effect sizes were moderated by the features of practice tests, participant and study characteristics, outcome constructs, and methodological features of the studies. Findings may guide the use of practice tests to advance student learning, and inform students, teachers, researchers, and policymakers. This article concludes with the theoretical and practical implications of the meta-analysis.

Regarding Class Quizzes: a Meta-analytic Synthesis of Studies on the Relationship Between Frequent Low-Stakes Testing and Class Performance

Lukas K. Sotola¹  • Marcus Crede¹

Regarding Class Quizzes: a Meta-analytic Synthesis of Studies on the Relationship Between Frequent Low-Stakes Testing and Class Performance

Lukas K. Sotola¹  · Marcus Crede¹

Abstract

We present the results of a meta-analytic synthesis of the literature on the association between the use of frequent low-stakes quizzes in real classes and students' academic performance in those classes. Data from 52 independent samples from real classes ($N = 7864$) suggests a moderate association of $d = .42$ between the use of quizzes and academic performance. Effects are even stronger in psychology classes ($d = .47$) and when quiz performance contributed to class grades ($d = .51$). We also find that performance on quizzes is strongly correlated with academic performance ($k = 19$, $N = 3814$, $r = .57$) such that quiz performance is relatively strongly predictive of later exam performance. We also found that the use of quizzes is associated with a large increase in the odds of passing a class ($k = 5$, $N = 1004$, odds ratio = 2.566).

Keywords Testing effect · Test-potentiated new learning · Class quizzes

Regarding Class Quizzes: a Meta-analytic Synthesis of Studies on the Relationship Between Frequent Low-Stakes Testing and Class Performance

Lukas K. Sotola¹  • Marcus Crede¹

- “Test-potentiated learning ... is the finding that testing people on certain material not only improves their memory for the tested material, but *also* improves their learning of subsequently presented material...” (p. 408).
- “... overall finding that quizzes tend to improve student performance, which will be an important insight for educators ...” (p. 422).

No – they don't!

Metacognitive strategies in student learning: Do students practise retrieval when they study on their own?

Jeffrey D. Karpicke

Purdue University, West Lafayette, IN, USA

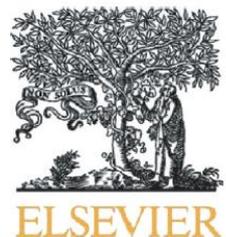
Andrew C. Butler and Henry L. Roediger III

Washington University in St. Louis, MO, USA

A majority of students repeatedly read their notes or textbook (despite the limited benefits of this strategy), but relatively few engage in self-testing or retrieval practise while studying. We propose that many students experience illusions of competence while studying and that these illusions have significant consequences for the strategies students select when they monitor and regulate their own learning.

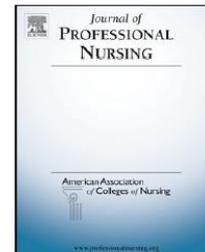


***Testing helps minimize the illusion
of competence***



Contents lists available at [ScienceDirect](#)

Journal of Professional Nursing



Testing enhances learning: A review of the literature

Sally Binks *

Toronto General Hospital, 200 Elizabeth Street, Toronto M5G 2C4, Ontario, Canada

The under-utilization of the testing effect

Despite the robust body of evidence in support of the testing effect, neither teachers nor learners generally recognize the benefits to learning of testing and, therefore, do not use it as a pedagogical or self-regulatory strategy.

“If you read a piece of text through twenty times, you will not learn it by heart so easily as if you read it ten times while attempting to recite it from time to time and consulting the text when your memory fails.”

Well, this is a relatively new idea
...right?

Francis Bacon, 1620



“Exercise in repeatedly recalling a thing strengthens the memory.”

Aristotle, 335 BCE



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Kent State University

Dunlosky and Rawson (2015)



- “...merely rereading the material does not offer a lot” (p. 73).
- “...*practice testing* and *spaced practice* ... These techniques really work” (p. 73).
- “...not only did students from large state colleges endorse the use of relatively ineffective strategies (such as rereading), but the college professors endorsed them too” (p. 75).
- “...it may be worthwhile to inform your colleagues about the best techniques as well” (p. 75).



Questions?

Conor T. McLennan
c.mclennan@csuohio.edu

