



# Using Low-Stakes Repeated Testing Can Improve Student Learning: How (Some) Practice Makes Perfect

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## Abstract

Two studies in Introductory Psychology classes explored whether repeated low-stakes testing can augment learning. In Experiment 1, answering more in-class questions with student response systems (SRSs) predicted better learning when students had not read the text. In Experiment 2, taking online practice quizzes predicted better learning, especially when questions on a concept were grouped. Repeated low-stakes testing can aid learning, but we must develop evidence-based pedagogical tools to maximize effects.

## Theoretical Basis

Repeated testing encourages retrieval and improves retention (Carpenter, Pashler, Wixted & Vul, 2008; Roediger & Karpicke, 2006), thus the testing effect may improve student learning. This effect has been studied in labs or using high-stakes course exams, but fast, easy, and non-threatening low-stakes tools may also benefit learning. Two examples include answering multiple choice questions (MCQs) in class using SRSs (Caldwell, 2007; Morling et al., 2008) and online in practice quizzes (Narloch, Garbin, & Turnage, 2006). Our classroom experiments in Introductory Psychology manipulated use of SRSs and the design of practice quizzes to determine what parameters of repeated testing elicit long-term learning benefits.

## Experiment 1

Using SRSs in class allows students to respond to MCQ comprehension checks from teachers. This makes each question a miniature, low-stakes quiz, which may aid memory and learning.



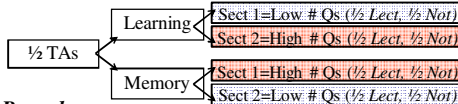
Introductory Psychology has used SRS for 3 years and TAs are trained on best practice. Participation using SRSs is 10% of students' grades and is earned by responding to 75% of the polls.

### Research Questions:

- Does the number of SRS Qs impact learning?
- Do effects of SRS Qs on learning persist?
- Do some groups benefit more from SRS Qs?

## Exp. 1: Methods

**Participants:** 297 students across 30 sections  
**Materials:** SRS Qs in class on Learning and Memory  
**Design:** Crossed between TAs and classes & reversed



### Procedures:

Pre-Test: 16 MCQs online 2 weeks before classes  
In-Class: Crossed design to present SRS Qs  
Post-Tests: 16 MCQs online 2 & 12 weeks after classes

## Exp. 1: Analyses

**Logit Mixed Model Analysis:** Best-fit models for 2 post-tests (correct/incorrect per item) account for predictor effects and control random variables.

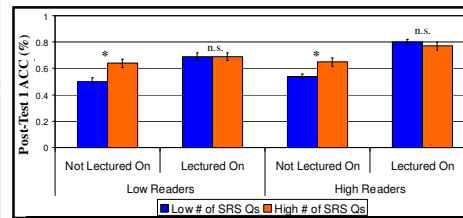
**Predictors:** Number of SRS Qs: (Low=4 / High=8)  
Coverage: (In Lecture / Not in Lecture)  
Read Text: (Low=<40% / High=>60%)

**Random:** Student; Question; Section

## Exp 1: Results

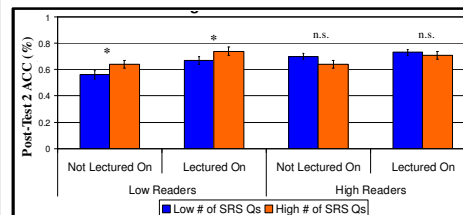
### Learning After 2 Weeks Predicted By High Number of SRS Qs

Only for topics NOT covered in lecture ( $z=4.7, p<0.001$ )



### Learning After 12 Weeks Predicted By High Number of SRS Qs

Only for "Low" readers ( $z=2.3, p<0.05$ )



## Experiment 2

Having more SRS questions improves learning when students have not read the text. Thus, a low-stakes tool like optional online practice quizzes on text material, may also aid learning.



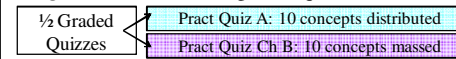
In Introductory Psychology, earning  $\geq 80\%$  on a practice quiz adds 0.5 points to online quiz scores.

### Research Questions:

- Do online practice quizzes aid student learning?
- Does the grouping of MCQs by concept (learning objective) affect learning?

## Exp. 2: Methods

**Participants:** 203 students from 1 section  
**Materials:** MCQs on text in online practice quizzes  
**Design:** Crossed between graded quizzes & reversed



### Procedures:

18 Practice Quiz: 30 MCQs/chapter 48 hrs before class  
9 Graded Quiz: 10 MCQs/chapter online 48 hrs after 10 classes covering 2 chapters

## Exp 2: Analyses

**Linear Mixed Model Analysis:** Best-fit model for percent correct on 9 graded quizzes accounts for predictors while controlling random variables.

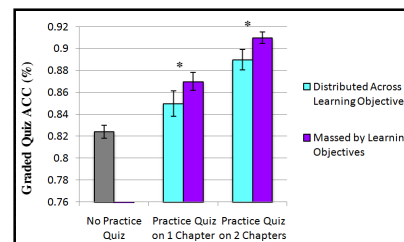
**Predictors:** Practice: (Yes / No)  
Number of Practice Quizzes: (1 / 2)  
Type of Practice: (Distributed / Massed)

**Random:** Student; Chapter; Question

## Exp. 2: Results

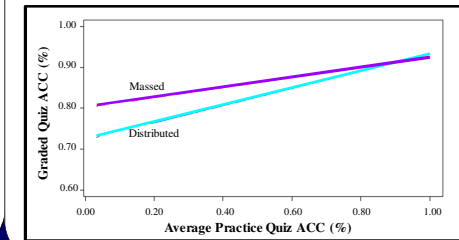
### Learning After 2 Weeks Predicted By Number of Practice Quizzes

Especially when concepts were massed ( $t=2.9, p<0.05$ )



## Exp. 2: Results (cont)

**Greatest Advantage of Massed Practice For Students Earning Lowest Practice Quiz Grades**  
( $t=-2.76, p<0.01$ )



## Discussion

The results add to the understanding of testing effects by revealing that repeated low-stakes testing improves student learning. Importantly, the results also indicate when repeated testing does, and does not, aid learning.

1. Using more SRSs to answer questions improves long-term learning when students have not read about the concepts in the text.
2. Answering questions on online practice quizzes aids long-term learning more when questions on a concept are grouped together.
3. The testing effect may not only be due to retrieval processes. Instead, attentional orienting to key concepts and development of schemas, as well as storage of this information, affect how repeated testing aids learning in the classroom. In sum, although practice can make perfect through repeated low-stakes testing, this depends on how teachers design the practice.

## Implications

Psychological science theories and methods can aid development of evidence-based pedagogical tools. Teachers may consider making small changes, as suggested below, to facilitate student learning.

- ☑ Have about 8 comprehension checks in class.
- ☑ Ask about text material not covered in class.
- ☑ Provide non-threatening practice quizzes.
- ☑ Group similar concepts in practice quizzes.

### Acknowledgments

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