UMass | Dartmouth
Amy Shapiro
Professor of Psychology
Ashapiro@umassd.edu

The Effect of Remote Response Technology on Attendance and Test Performance in Large Classes

ABSTRACT

Students in a General Psychology course of 210 students indicate each semester on course evaluations that the class is a campus favorite, yet attendance and attention in class are low. Since students can't learn if they aren't there, an experiment was conducted to evaluate remote response technology for boosting attendance and test scores. Students were required to purchase "clickers" and answer in-class questions that counted toward final grades. Attendance rose by over 30% as compared to extra credit but was equivalent to giving pop quizzes. Performance on test items that were targeted by in-class questions rose by 26% while control test questions that were not targeted with in-class questions rose by only 4%. Two theories that may explain the effect are discussed.

INTRODUCTION

The Class

- General Psychology (PSY101); enrollment 210
- Survey course covering a broad spectrum of ideas
- Class relies largely on lecture format
- Taught with Powerpoint multimedia "shows" including audio, video and in-class demonstrations
- Class is a student favorite, professor highly recommended by students (4.6/5.0 average rating for quality of instructor)

The Problem

- Poor attendance and inattention
- Students can't learn if they aren't there or paying attention

The Solution?

- Use remote response technology (RRT) every day
- Students required to purchase a device (iClicker)
- Integrate RRT questions with Powerpoint slides
- Some questions promote discussion, others scored for points earned toward final grade

Research Questions

- Does RRT increase attendance?
- Does RRT affect learning?

METHOD

Subjects

210 students enrolled in the class for fall 2007. Test performance and attendance from the same class in fall 2006 was used for baseline comparisons. An IRB waiver was obtained to do the analyses.

Stimuli & Materials

The course was identical to the course taught in fall 2006, including all lectures, Powerpoint slides and exam questions. The difference was the addition of the iClicker brand RRT and in-class questions. The instructor's hardware and software were supplied at no cost by iClicker and students were required to purchase a remote ($20-35).

All RRT questions used for the study were factual, asking only about basic information presented in class. The relationship between the RRT questions and test questions created 3 experimental conditions and 2 control conditions, as listed in Table 1.

Table 1. *The 5 conditions of the study.*

Experimental Condition	RRT Item	Test Question
Identical (RRT & test items were the same)	Factual	Factual
Reworded (RRT & test items on same topic but questions differed)	Factual	Factual
RRT-Paired Conceptual (RRT & test items on same topic; test item required critical thinking)	Factual	Conceptual
Control-Factual	None	Factual
Control-Conceptual	None	Conceptual

Test Items

- 2 tests (covering 6 chapters) given in Fall 2006 before adopting RRT were reused in Fall 2007.
- 30 multiple choice questions embedded in the tests were included in the analyses.
- Test question types:
  - -18 factual (3 from each chapter)
  - -12 conceptual (2 from each chapter)
  - -Normalized as closely as possible (% of the class getting each correct in fall 2006)

Analyses

Attendance. The average number of student responses per day was recorded and used to calculate the average percent of students in class each day. This figure was compared to prior fall semesters in which other incentives to attend class were offered. Attendance for those semesters was determined by calculating the mean number of papers handed in during class.

Learning. The percent of students correctly answering each question in fall 2007 (with RRT) was calculated. The percent of the class getting the same question correct in fall 2006 (without RRT) was also calculated. The difference score between the RRT and control classes was calculated for each question. The 6 difference scores for each of the 5 conditions (see Table 1) were averaged to arrive at a mean difference score for each condition.

RESULTS

Attendance

- Attendance with RRT increased by over 30% as compared to a class given extra credit as as incentive, as shown in Table 2.
- Attendance with RRT is equivalent to using pop quizzes as an incentive, as shown in Table 2.

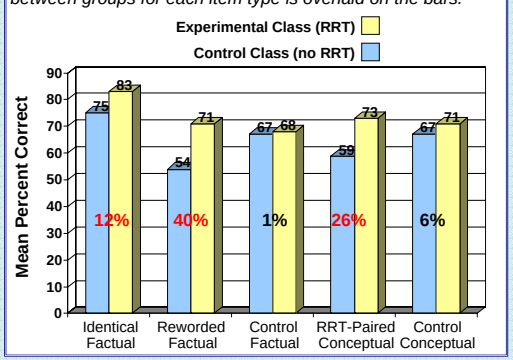
Table 2. *Relative effects of different interventions on mean daily attendance.*

Intervention	Semester	Average Attendance
Pop Extra Credit	Fall 2005	61%
Pop Quizzes	Fall 2006	80%
RRT	Fall 2007	81%

Learning

- Using the Fall 2006 class (with no RRT) as a baseline, overall performance on experimental items (with RRT-paired questions in Fall 2007) rose by 26% (from 63% to 76%), while performance on control items (with no RRT-paired questions offered in Fall 2007) increased by only 4% (from 67% to 69%).
- Using the control class as a baseline, the RRT class improved significantly more on RRT-targeted factual test questions than on factual control items ($X^2(2) = 43.9, p < .001$), as illustrated by the first 3 sets of bars in Figure 1.
- Using the control class as a baseline, the RRT class improved significantly more on RRT-targeted conceptual test questions than on conceptual control items ($X^2(1) = 11.7\ p < .001$), as illustrated by the last 2 sets of bars in Figure 1.

Figure 1. *Relative performance on target and control items by the RRT class and the no RRT class. The mean % difference between groups for each item type is overlaid on the bars.*



CONCLUSIONS

RRT enhanced attendance at a level comparable to pop quizzes, without requiring distribution and collection of papers from hundreds of students. Moreover, using RRT is simple and grades are extremely easy to import to grade books or files. Based on its ease of use and effectiveness in boosting attendance, I would never again consider teaching a large class without it! The effects, however, were more profound than attendance. Students' test performance demonstrated greater retention and comprehension of information that was targeted by RRT questions. The effect can't be attributed to the attendance increase because (1) performance on control items did not increase along with the target items and (2) attendance was comparable in the baseline semester (Fall 2006).

Why did the RRT enhance learning? There are two competing explanations. The first possibility is that the RRT questions merely highlight important ideas for students. In other words, the effect may come about by prompting students to direct attentional resources to specific items during class and in subsequent study. The second possibility is that retrieval is acting as a source of memory encoding. Known as the *testing effect*, it has been shown that the act of recalling a piece of information can strengthen it in memory (Roediger and Karpicke, 2006). As such, it is possible that, by asking students to retrieve a piece of information in the moments just after encoding it, RRT questions help students solidify memory for the relevant information.

FUTURE WORK

Future work will be directed at two goals. The first will be to distinguish between the two competing theories that may explain the effects of this study, the *testing effect* versus *directed attention*. If the testing effect is the source of RRT's effect on test performance, it would mean that RRT technology offers a true learning advantage rather than mere study prompts. Such a result would be important to our understanding of both learning theory and pedagogical practice. The second goal will be to explore the use of RRT for promoting critical thinking through small group discussions in large classes. I am interested to know whether having students discuss applied questions in class and respond with their "clickers" as a group will enhance fact retention and problem solving ability on tests.

REFERENCES

Roediger, H. & Karpicke, J. (2006). Test-enhanced learning: Taking memory tests improves long-term retention. *Psychological Science, 17*, 249-255.