

## USING FREQUENT TESTING TO INCREASE STUDENTS' MOTIVATION TO ACHIEVE

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**Abstract:** My research focused on comparing two approaches for the recall and understanding of given text material: (a) frequent testing to provide incentive motivation, and (b) outlining as a homework assignment to provide a study strategy. A total of over 300 college students were used in three experiments, conducted in an actual course involving real grades. In one of the studies, students were classified into high, middle and low groups on prior academic achievement (GPA), and in another, students were classified as high, middle, and low procrastinators based on Procrastination Scale scores. In one condition, tests were given on a weekly basis. These were designed to minimize transfer to three regular examinations, which were used as criterion measures of achievement. In the second condition, weekly homework assignments required students to identify, define, and elaborate on chapter main points. Frequently tested students, overall, were found to outperform homework students on examinations in all three studies. The difference was found to be based on dramatically large differences (10% or a full letter grade) among low GPA students (in one study), and among high procrastinators (in another) favoring students in the frequent test condition.

### USING FREQUENT TESTING TO INCREASE STUDENTS' MOTIVATION TO ACHIEVE

I had been doing research on enhancing students' academic engagement and achievement in college (e.g., Tuckman, 1990; Tuckman & Sexton, 1990, 1991, 1992) and had begun to suspect from my results that many poorly performing students were knowledgeable about study skills and self-regulation strategies, but simply failed to use them. Typical low achievers did not seem to spend the necessary time and effort, or apply themselves in the necessary way, to get the information they were learning in their classes into their long-term memories. What they seemed to lack was not intellect or skill, but drive.

I had come to the conclusion from my own work and that of others that achievement required aptitude and motivation, and motivation required a combination of attitude, strategy, and drive (Tuckman, 1999). I had been able to improve both attitude (Tuckman & Sexton, 1991) and strategy (Tuckman, 1992), but had not found a way to increase drive. I had begun to think about what it might be that finally drove a student to get information into long-term memory, when it hit me: tests! Tests motivate students because they create the opportunity or necessity to achieve success or avoid failure. In that way, tests provide an incentive to learn. They are a source of incentive motivation.

Pintrich and Schrauben (1992) review a large body of research that suggests that (1) the value of an outcome to the student affects that student's motivation, and (2) motivation leads to cognitive engagement, such engagement manifesting itself in the use or application of various learning strategies. If not directly taught to these students, the use of these strategies would suggest that they already exist in the student's repertoire. Thus, if enhancing incentive value or incentive motivation by itself actually improves outcomes, the explanation is likely to be that effective cognitive engagement has occurred.

Incentive theories of motivation (e.g., Rotter, 1954, Rotter, Phares and Chance, 1972; Overmier and Lawry, 1979, Petri, 1998) suggest that people will perform an act when its performance is likely to result in some outcome they desire, or that is important to them. For example, in anticipation of a situation in which a person is required to perform, that person may expend considerable effort in preparation because of the mediation provided by the desire to achieve success or avoid failure. That desire would be said to provide incentive motivation for the person to expend the effort. Hence, I theorized that a test, as a stimulus situation, would provoke students to study as a response, because they link a behavior to a goal, namely the achievement of a successful grade or avoidance of a failing grade on that test. Putting in the effort to study for the test, which means attempting to get potential test content into long-term memory, therefore, would be the result of incentive motivation.

It was now necessary for me to devise a way to test the hypothesis that tests prompted better achievement, and that they did so because they motivated students to get what they were being taught into their "heads" (or long-term memories). If I could show that, then it would also imply that they already knew appropriate learning skills and strategies.

I was fortunate to have available to me a number of sections of the same course, covering the same material, and using the same textbook, and examinations. This was ideal, since I felt that academic motivation and performance could be better studied in real classes involving real consequences (i.e., grades) than under simulated conditions. I needed something to compare frequent testing to that (a) caused students to spend equal time working on course materials - controlling for time-on-task, (b) could be graded, (c) did not motivate students to get information into their long-term memories - the essential feature of tests, and (d) enhanced study skills - as an alternative explanation. What I came up with as a comparison to frequent testing was required homework, namely: to outline each chapter by identifying the 20 most important concepts, and provide a textbook definition and elaboration (i.e., a description in one's own words) of each.

#### Methods

I did essentially the same study three times; (1) on a five week segment of the 15 week course, in which I also included a third group that got neither tests nor homework; (2) on the whole course, where I included only tests and homework conditions, I required all students to keep a log of time spent on coursework, and I compared the results for high, middle, and low GPA students; (3) exactly the same as the second time except I measured students tendency to procrastinate (using the Procrastination Scale; Tuckman, 1991), and compared results for high, middle, and low procrastinators.

**Subjects.** Numbers of subjects in each study ranged from 110 to 120. They were juniors and seniors in college, all preparing to be teachers as either a major or a minor, having an average age of 21, two-thirds women, and about 92 percent white. They were enrolled in three sections (in the first study) or two sections (in the second and third study) of an educational psychology course required for teacher certification. All sections met once a week (on consecutive days) at the same time of day, covered the same content (learning theories), used the same textbook, and were taught by the same instructor. They were randomly assigned to treatment conditions. A comparison of the sections used in each study on age, gender, and scores on the verbal portion of the College Level Academic Skills Test (CLAST) showed them to be equivalent, thus satisfying the requirements for a quasi-experimental design. Correlations between CLAST verbal scores and achievement in this course have been found to be about 0.5 (Tuckman, 1993).

**Treatments.** (1) Frequent test condition. One class in each study was given a 15 minute, seven-item, completion-type test at the beginning of each class period (i.e., prior to instruction), covering the textbook chapter assigned for that week. Following the test, students exchanged papers, and the answers were gone over by the instructor so that students could grade one another's tests. Students were informed that the average of their grades on these tests would count toward their final grade as much as one of the three major course examinations.

(2) *Homework condition.* One class in each study was given the homework assignment of identifying the 21 most important terms in the assigned chapter, and preparing a definition of each term along with a one-sentence elaboration of each. A list of about 28 terms was predetermined for each chapter, and students' choices had to fit this list. If a term chosen by a large percentage of students was not on the list, it was added. The text included no glossary, but many signals so that term identification was not difficult. For example, in the chapter on reinforcement theory, a key term would be "reinforcer," its definition would be "something that increases the likelihood of occurrence of the response it follows," and an elaboration might be "getting something good to eat after doing my homework." Students were given some training before they started and after having done two assignments. They were also given feedback on all aspects of each assignment so their proficiency would improve. Each assignment was graded (A, B, or C) based on number of correct terms included, correctness of definitions, and appropriateness of elaborations. These grades were averaged and counted as much toward the final grade as the average of frequent test grades in the testing condition.

In the first study only, there was also a Control condition, that is, a class given only lectures on the chapters (no frequent tests, no written homework).

**Moderator Variables.** In the second study, grade point average (GPA) was used as a moderator variable, as was procrastination tendency in the third study. For GPA the ranges were high (3.6-4.0), medium (2.9-3.5), and low (2.0-2.8), while for procrastination they were divided into tertiles.

**Dependent Variable.** One (in the first study) and three (in the second and third study) 50-65 multiple-choice item tests, matched to instructional content, were given to measure achievement outcomes. The tests had a K-R reliabilities of .82-.87. While virtually all of the questions on this test related to key terms, a key feature of the TDE homework assignments, they measured comprehension rather than factual recall. In other words, they were higher-order or conceptual questions. Students were typically asked to identify the concept that fit a given example or the example that fit a given concept. For example, "According to the PREMACK PRINCIPLE, which of the following reinforcers would be most appropriate for the given group? a. Money for adults; b. Tokens for inner city children; c. Playing for third graders; d. Praise for teenagers." (The answer is c. since the Premack principle applies only to activity reinforcers and playing is the only activity among the four choices.) This conceptual feature made them equally unlikely to favor the frequent test condition either, since the questions on the frequent tests were all completion-type measures of factual recall. Moreover, frequent test questions were intended to measure care taken in reading the chapter, and so focused on details and specific points. As a result there was minimal overlap between questions on the examinations and on the frequent tests.

#### Results and Discussion

This is what I found. In all three studies, students in the frequent testing condition earned significantly higher examination grades than students in the homework condition (and in the control condition in the first experiment). The difference ranged from a whole grade (a B compared to a C) to a third of a grade (a B- compared to a C+).

In the first study, the final achievement test results for the three approaches were as follows: frequent test mean=82.8 (sd=9.3), homework mean=71.6 (sd=9.4), control mean=66.9 (sd=12.6). The ANOVA for condition yielded  $F=21.69$  ( $df=2/106$ ),  $p<.001$ . Cell comparisons by Newman-Keuls test showed the frequent test approach to yield significantly better results ( $p<.001$ ) than either of the other two conditions, while homework exceeded the control at the  $p<.10$  level. The effect size is near or above 1.00 for each comparison with the frequent test results.

What was considerably more dramatic and revealing were the results for students at different GPA levels (in the second study) and different degrees of procrastination (in the third). Regarding GPA, there were no differences in examination grades between frequent tests and homework conditions for students with high (3.6-4.0) or middle (2.9-3.5) GPAs. However, for students with low GPAs (2.0-2.8), those in the class given frequent tests averaged 76% (B- on the grade scale) across the three tests compared to 66% (C-) for those in the homework class, a highly significant difference of 10 percent on a 100-point scale. In fact, the low GPA students given frequent tests did so well they outscored the middle GPA students in both the homework and frequent test conditions. These results are shown in [Figure 1](#).

For procrastination level, the findings were even more dramatic. High procrastinators in the frequent test condition not only significantly outscored high procrastinators in the homework condition (by over 10%, or a full grade), they outscored both middle and low procrastinators in both homework and test conditions. These results are shown in [Figure 2](#).

The overall results clearly showed that frequent tests worked better than homework in improving achievement, but this was primarily because of its dramatic effect on students with low GPAs and high procrastination tendency (characteristics that may, in fact, reside in the same students). This suggests that a low GPA does not necessarily reflect either low academic ability or the absence of study skills, but the lack of motivation to do

timely study in such a way to internalize course content. Similarly, high procrastinators have their inability to get started to blame for their poor academic performance. In regard to time, students in the frequent test condition actually reported spending somewhat less than homework-condition students.

An issue relevant to the interpretation of the results is the extent to which the frequent tests worked, not as an incentive to study, but as a direct training aid or targeted study guide for the achievement exams. However, the nature of the items was quite different, the former being factual/short answer and the latter conceptual/multiple-choice. Moreover, the achievement exam questions were as similar to the homework assignments as to the frequent tests. Further, from the empirical perspective, if the frequent tests were merely study guides, they should have helped students at all three GPA levels, particularly those middle and low. While they did help the low GPA students substantially, they had no effect at all on the middle GPA students. This suggests that the frequent tests enhanced motivation for students who have typically performed poorly to get content into long-term memory rather than merely targeting for them what to study.

Another issue is one of exactly what it was that the students in the frequent test condition were motivated to do that differentiated them from students in the homework condition, since both tests and homework assignments were graded, and students in the homework condition actually devoted more time to the task than their counterparts spent studying for tests. My speculation is that homework involves using the text to prepare a document on paper, thereby providing no motivation to store text information in long-term memory. Tests, on the other hand, require such storage in order to have access to the information while taking the test. Therefore, the incentive motivation based on the grade for test takers would be linked to the motivation to store information in long-term memory while, for homework doers, it would not.

My work should send a message to students. Even if professors don't give frequent tests (although my findings suggest that they should), students should test themselves on a regular basis to insure that they are getting what they learn into long-term memory. If they wait till the midterm, there will be too much information to process in too short a time. Procrastination may be what causes students to end up with a low GPA.

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