Increasing Students' Attendance at Lecture and Preparation for Lecture by Allowing Students to Use Their Notes During Tests

Paul A. Messling III and Marshall L. Dermer

Abstract

In an upper-division, college course with a lecture component and two laboratory sections, we experimentally evaluated a treatment package that included this contingency: "only if students attended lecture and submitted notes for each day's reading assignment could they use their notes during a later test," and instructions about the contingency. We examined whether the instructed contingency enhanced: (a) students completing notes on reading assignments before lecture and (b) their attending lecture. Although the instructed contingency improved these behaviors, improvement depended on the semester we conducted our experiment and the students' laboratory section. The instructed contingency was, however, most helpful where most needed: for the laboratory whose students had the lowest attendance rates at lecture. For these students the instructed contingency-- a non-punitive, inexpensive intervention-- enhanced preparation for and attendance at lecture across two experiments and appeared to support such behavior in subsequent offerings of the course.

Keywords: attendance, preparation, college students, Response Deprivation Hypothesis, Premack Principle, classroom management, instruction, withdrawal design

---

Many college students appear uninterested in learning. For example, a survey of sociology majors at a mid-sized public university found 73% agreeing that they would take a course where they earned an A but learned little or nothing and 53% agreeing that the instructor was responsible for keeping students attentive in class (Delucchi & Korgen, 2002). Material of direct interest to students, however, cannot always be taught. This is often true in introductory courses in the sciences where students must learn basic principles and concepts. Indeed, the importance of learning may only become evident after students have completed courses.

On a day-to-day basis then, instructors may find themselves teaching material of little interest to students. So, substantial numbers of students may never or rarely complete reading assignments on schedule (e.g., Conner-Greene, 2000; Slish, 2005; Vandehey, Marsh, & Diekhoff, 2005) and many may skip lecture (Vandehey et al., 2005). In the near future these academic behaviors may worsen as more students hold outside jobs. Of students attending college for four years, about 75% report working while attending college, with about 25% working full time, presumably to cover ever-increasing tuition costs (Choy, 2002). Given decreasing public support for higher education, the deleterious effects remunerated work may have on academic behavior, and other contingencies that support student consumerism-- how can we enhance preparing for and attending lecture?

One approach to increasing the number of students who prepare for lecture is by reinforcing preparation. For example, Carkenord (1994) wanted his students to come to class prepared to discuss assigned journal articles. So, he awarded students course credit for bringing a brief summary and critique of the articles to class and submitting these notes at the class's end. Most importantly, beyond offering course credit, Carkenord also returned these notes so students could use them during tests. He reported that students typically submitted notes for about 74% of the articles.

Carkenord neither experimentally evaluated his instructed contingency nor explored whether offering course credit was necessary to support his students reading assigned materials and completing notes before class. It is possible that such desirable academic behavior could have been supported by allowing students to later use their notes during tests. That such use may function as a reinforcer is an

implication of the Response Deprivation Hypothesis (Timberlake & Farmer-Dougan, 1991) which suggests that constraining behavior below baseline levels renders that behavior reinforcing. Constraint appears present in most test situations when notes are prohibited.

But what suggests that without the prohibition students would bring notes to tests? First, when people must respond in new ways they often use prompts. For example, an instructor is likely to use note cards, overhead transparencies, or PowerPoint® slides when presenting new material. Similarly, students may be disposed to use notes when answering test questions on new material. The best evidence for this is students illicitly constructing and using "cheat sheets" during tests.

Thus, we reasoned that sanctioning note use during tests could reinforce desirable academic behavior. More specifically, we designed a two-component treatment *package* which included instructions about an "attendance/submission contingency" and the contingency: only if students attended lecture and submitted hand-written notes for each day's reading assignment could they use their notes during a later test. We experimentally evaluated this "instructed contingency" in a course where the percentage of students attending lecture typically was only about 70% and, worse yet, only about 30% of the students attending reported having read the day's reading assignment.

In this course, weekly tests were based primarily on material presented in the course's text. During lecture, the instructor generally discussed difficult sections of the text or recent developments, answered students' questions and encouraged class discussion (Michael, 1991). For analytic purposes, we rarely examined students on material that was exclusively presented in lecture because this procedure can increase attendance and could, therefore, obscure detecting the instructed contingency's effects on attendance (Lloyd, Garlington, Lowry, Burgess, Euler, & Knowlton, 1972). In this context, we examined whether the instructed contingency would support students preparing notes before lecture and enhance their attending lecture.

Method

Participants and Laboratory Sections

Participants were mostly college seniors, enrolled for the entire semester, in upper-division sections of an applied behavior analysis course. For the fall 2002 semester, 20 students enrolled; for the spring 2003 semester, 25 students enrolled. Scheduled for 50 min were lectures on Tuesdays and Thursdays and tests on Fridays. Also scheduled for about 3 hrs weekly, were an off-campus laboratory section that met throughout the city at various times; and an on-campus laboratory section that met after lecture in a nearby room.

The students in the off-campus laboratory were trained by local autism service providers as line therapists and paid $8 per hour. Students' grades for this laboratory were based on the logs they kept of their daily therapy sessions, five training programs they had annotated with the technical vocabulary of behavior analysis, and evaluations they received from the autism service providers.

The students in the on-campus laboratory completed two instructional units. The first unit focused on instructional design. Students read and discussed articles, used fluency software to improve the quality of their writing (Dermer, Lopez, & Messling, 2009), and then designed and documented a fluency training/ Precision Teaching unit of their own design. In the second unit, students read and discussed articles concerned with functional assessment and then worked with *Simulations in Developmental Disabilities,* multimedia software that provides practice in applying behavior analysis with children and adults (Desrochers, Clemmons, Grady, & Justice, 2000). Groups of two to three students worked through the program's various cases and discussed problems and strategies. Students' grades for the laboratory were

based on the quality of the instructional unit they had designed and its documentation; and participation in laboratory which included attending meetings.

Procedure

The syllabus described the baseline attendance/submission contingency: If students attended lecture and submitted notes for that day's reading assignment they could use their notes during a later test. The syllabus also instructed students to handwrite their notes on one side of standard paper (to prevent mechanical duplication) and to indicate the date and time they completed their notes. When the contingency was present, the notes were collected at the beginning of lecture and were later inspected to verify that they covered only the reading assignment. Notes were then color coded so students could not easily introduce unauthorized notes during tests. These notes were later distributed at the beginning of the Friday test session.

Although the syllabus instructed students to complete all assignments and answer study questions *before* lecture, the syllabus also indicated that for some weeks the attendance and submission requirements would be suspended. For these weeks, notes were not collected at the beginning of lecture; instead students could bring their notes for use during the test session. (After tests these notes were collected and inspected to verify that the notes for a given day were based only on that day's readings.)

Students also read an IRB-approved informed consent form. Students learned that if they declined participation they would not be research participants and their data would not be used in publications. Furthermore, for these students the instructed contingency would be in place throughout the semester. In fact, a similar contingency had been used for many semesters with considerable apparent effectiveness but had not been experimentally evaluated. All students consented.

Besides presenting the above instructions at the beginning of the semester, the instructor periodically provided other instructions during the semester. At the beginning of the Friday test session, the instructor announced whether the contingency would be in effect the following week and the reading assignment for the following Tuesday. At the end of the Tuesday lecture, he announced the reading assignment for the following Thursday. Besides these oral instructions, on Fridays the instructor also described the contingency for next week on the course list server.

Design and Variables

We used a withdrawal design to assess the effects of the instructed contingency on lecture attendance and reports of when notes were completed. Generally within the first 5 min of lecture, we counted the number of students present. When students had legitimate explanations for missing class (e.g., a funeral, a documented medical problem, or a required appearance in court) we allowed them to use their notes on tests and analyzed the times they reported. Interobserver agreement was 100% for counting the students attending (agreement assessed for 90% of the lectures) and reading the reported times from notes (agreement assessed for 25% of the notes).

Results

Figure 1 depicts the number of students attending lecture on Tuesdays and Thursdays. The ticks on the x-axis represent the days of the week with each date, for example 9/9, indicating a Monday. A "P" indicates the instructed contingency's presence; an "A" indicates the instructed contingency's absence.

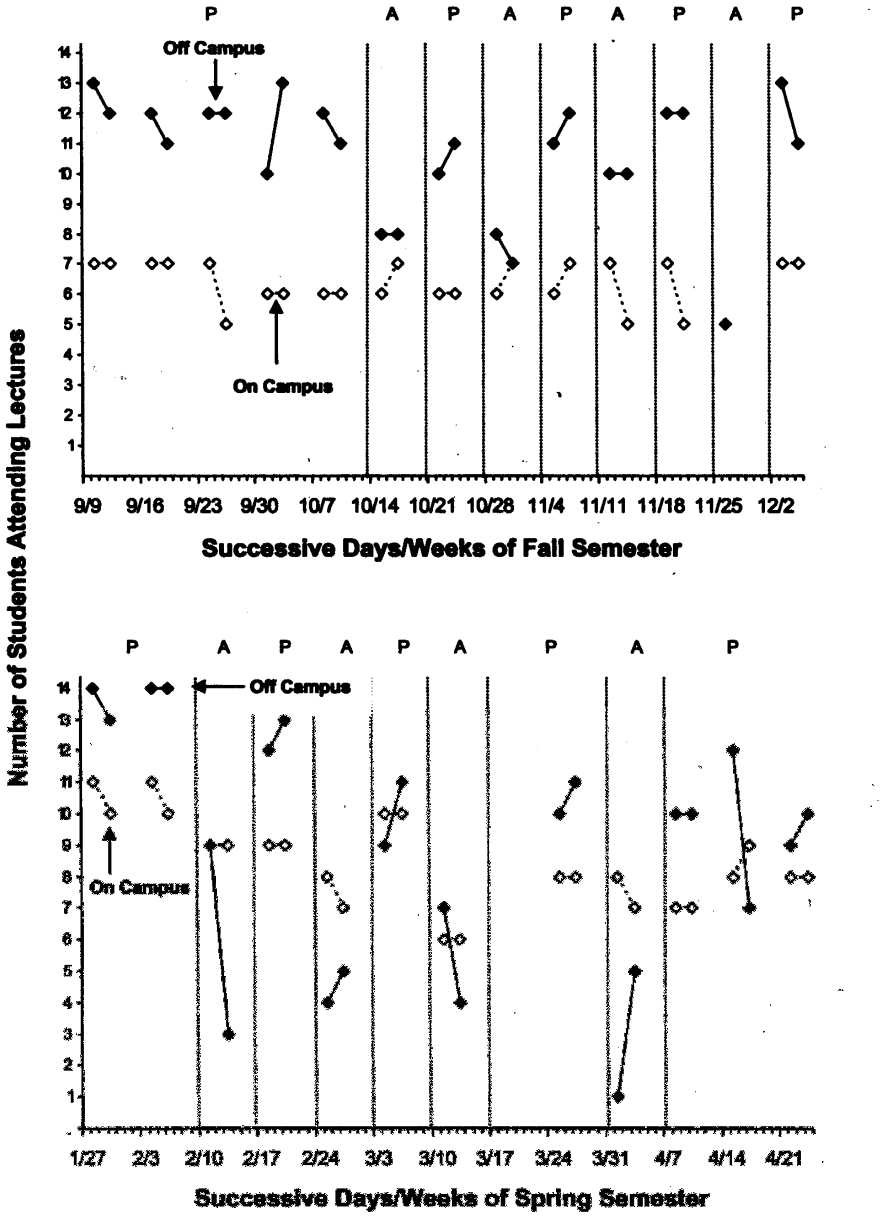

Figure 1. For the fall laboratories (top panel) and the spring laboratories (bottom panel), the number of students attending lecture on Tuesdays and Thursdays as a function of the seven days of each week and the instructed contingency's presence (P) and absence (A). Worth noting is that on November 26, the lecture before Thanksgiving, five students from each laboratory attended.

The first data point indicates the number of students enrolled in a laboratory for the semester's duration.

Figure 1 reveals that for the students from the *off-campus laboratory*, lecture attendance for weeks when the instructed contingency was absent was always lower than lecture attendance for the preceding or following week when the instructed contingency was present. During the fall semester, on average just

8.0 students attended lecture when the instructed contingency was absent (62% of the 13 students from this laboratory); but 11.5 students attended when the instructed contingency was present (88% of the 13 students). This is a 26% increase in lecture attendance. For the spring semester, on average just 4.8 students attended lecture when the instructed contingency was absent (34% of the 14 students from this laboratory); but 11.2 students attended lecture when the instructed contingency was present (80% of the 14 students). This is a 46% increase in lecture attendance.

Our experimental design involved repeatedly withdrawing and reinstating the instructed contingency. So, this contingency's maintenance of high lecture attendance, for students in the *off-campus laboratory*, might depend on the contingency having been recently withdrawn. The implausibility of this dependency is suggested by two patterns of data. First, during the first five weeks of the fall semester the instructed contingency was in effect, without previously having been withdrawn, and attendance was high (see Figure 1, top panel). Moreover, this high attendance does not appear merely due to the data having been collected at the semester's beginning. Why? Because during the first five weeks of the spring semester the instructed contingency was twice withdrawn (2/10 and 2/24) and each time attendance precipitously dropped for the week for the students in this comparable off-campus laboratory (see Figure 1, bottom panel). Moreover, the attendance for students in this off-campus laboratory provide the second data pattern that suggests that instructed contingency's support of high attendance did not depend on its having been recently withdrawn. For the weeks of 3/24, 4/14 and 4/21 the instructed contingency was present and attendance was high for the off-campus laboratory even though at least a week had passed since the contingency had been withdrawn. This outcome would not be expected if the effect of the instructed contingency depended on its being recently withdrawn.

In contrast to the strong effects of the instructed contingency on the attendance of the students from the off-campus laboratory, the contingency did not reliably increase lecture attendance for students from the *on-campus laboratory*. During the fall semester, Figure 1 reveals that attendance did not covary with the instructed contingency's presence or absence. The average number of students attending lecture from this laboratory was 6.3 when the instructed contingency was present and 6.1 when the instructed contingency was absent (for either case about 90% of the 7 students in the laboratory). During the spring semester, Figure 1 reveals that attendance covaried only modestly with the instructed contingency's presence or absence. Although lecture attendance was lower during the weeks of 2/24 and 3/10 when the instructed contingency was absent than for the immediately preceding or following weeks when the instructed contingency was present, this pattern of strong control was not evident for the weeks of 2/10 and 3/31 when the instructed contingency was also absent. For the spring semester, on average 7.5 students attended lecture when the instructed contingency was absent (68% of the 11 students from this laboratory) and 8.9 students attended lecture when the instructed contingency was present (81% of the 11 students). Although this is a 13% gain in attendance, the instructed contingency, as noted, did not appear to strongly control attendance.

Figure 2 depicts the average time, rounded to the closest hour and relative to the beginning of the corresponding lecture, at which students reported completing their notes. During the fall semester the instructed contingency reliably enhanced reported times only for students from the off-campus laboratory. Because the average for these students for Tuesday, October 15 is particularly interesting, we've placed a square around this datum. For these students, for the remainder of the semester, unless the instructed contingency was present, students reported times which were on average negative. That is, they typically completed their notes *after* lecture. Worth noting is that except for 10/29, the students from the on-campus laboratory always reported completing their notes before lecture.

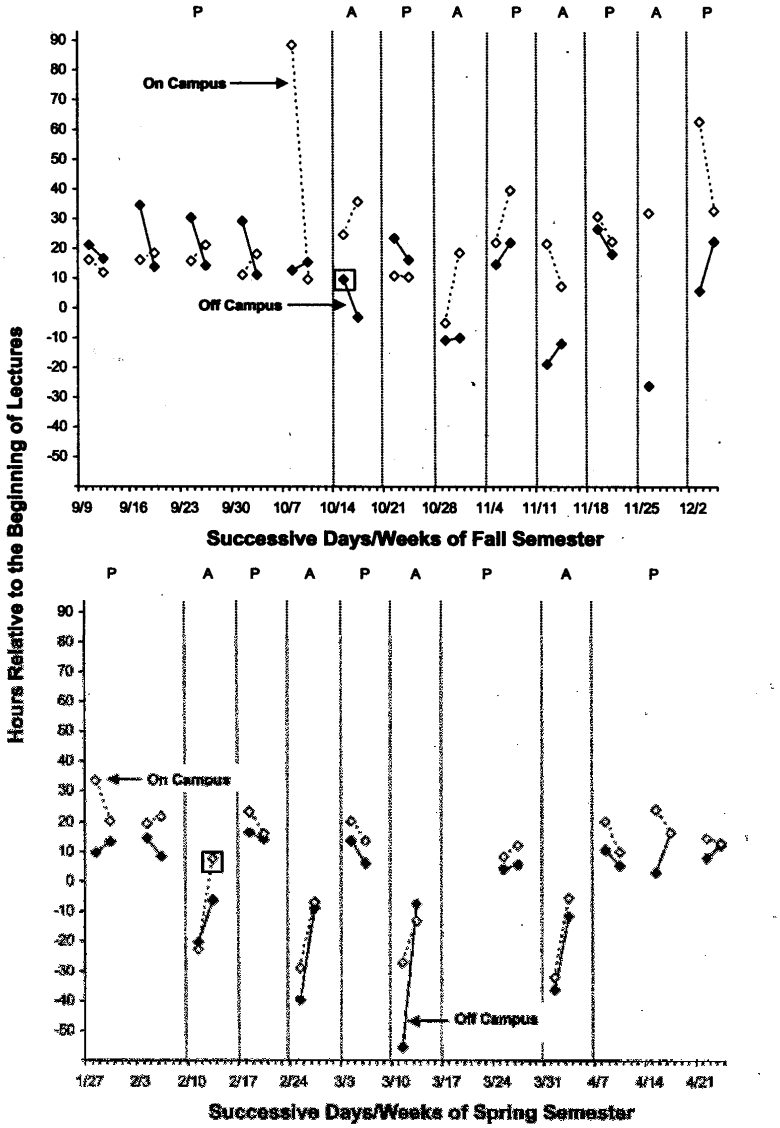

Figure 2. For the fall laboratories (top panel) and the spring laboratories (bottom panel), the average times, relative to the beginning of a lecture on Tuesdays and Thursdays, at which students reported completing their notes as a function of the seven days of each week and the intervention's presence (P) and absence (A). (See text for explanation of boxed data.)

During the spring semester the instructed contingency enhanced reported times for students from both laboratories. Because the average time for students from the on-campus laboratory for Thursday, February 13 is particularly interesting; we've placed a square around this datum. For the remainder of the semester, unless the instructed contingency was present, students from both laboratories typically reported completing their notes *after* lecture. Given that Figure 2 is based on self-reports, it is desirable to examine the percent of students who had brought notes to lecture, for these are *public* data. The most desirable comparison would be to examine this behavior as a function of the instructed contingency. But students were not required to bring notes to lecture on the weeks the instructed contingency was absent. So, the best we can do is report the percent of students who brought notes to lecture when the instructed contingency was present. Though we collected these notes, we unfortunately augmented the counts with

counts for notes submitted by students with legitimate reasons for missing lecture. Because these additional submissions were rare, however, we can conservatively estimate the proportion of students registered for each laboratory who submitted notes at the beginning of lecture by computing the median for the lectures when the instructed contingency was present. This analysis was most easily conducted for the spring semester; the median percent of students submitting notes was 79% for the off-campus laboratory and 82% for the on-campus laboratory.

Discussion

We examined whether our instructed contingency enhanced two behaviors: rates of attendance and when notes were prepared relative to lecture. The effects of our instructed contingency depended on contextual variables and behavior.

Regarding lecture attendance, for both semesters, the instructed contingency substantially enhanced attendance for students from the off-campus laboratory but not for students from the on-campus laboratory. Because students were not randomly assigned to laboratory sections, this differential effect may be due to the type of student choosing each laboratory. Other explanations for this effect may be based on differences between the laboratories. The most notable difference is that for students from the off-campus laboratory, the 2 PM lecture was probably the last class of the day. In contrast, for all students from the on-campus laboratory, the 2 PM lecture was immediately followed by the laboratory where attendance contributed to students' laboratory grades.

For the off-campus laboratory, the intervention increased attendance almost twice as much during the spring semester (46%) than it did during the fall semester (24%). During the fall semester, the average percentage of students who attended lecture was 88% when the instructed contingency was present and 62% when the instructed contingency was absent. During the spring semester, the average percentage of students who attended lecture was 80% when the instructed contingency was present and just 34% when the instructed contingency was absent. The latter low percentage may account for the intervention's large effect during the spring semester. Perhaps attendance was low when the instructed contingency was absent during the spring due to the contingencies in effect for graduating seniors. For example, their grades for the spring semester could neither much change their overall grade point averages nor their chances of acceptance the following fall into graduate or professional schools. Similarly, their grades could not much affect their immediate chances of securing employment. Such contingencies have been described as producing "senioritis": ". . . sleeping late, not paying attention or even *skipping classes* [italics added], spending the day searching job hunting sites, and daydreaming about a life in the 'real world'" (Wisneski, 2005). Regardless of the explanation for these differential increases in attendance, the increases appear socially significant.

Regarding enhancing preparation, the instructed contingency did not appear substantially to enhance preparation of the students in the fall, on-campus laboratory. This is not surprising as students in that laboratory typically completed reading assignments before lecture. But for the other fall laboratory and for both spring laboratories the instructed contingency did enhance preparation. Evidence for such preparation comes, in part, from students' *reports* of when they completed their notes. Additional evidence for the instructed contingency promoting preparation derives from the percentage of students enrolled who *submitted* notes before lecture. During the spring semester, this percentage was about 79% for students from the off-campus laboratory and 82% for students from the on-campus laboratory. Although we did not formally analyze these handwritten notes, they generally were extensive often covering essential aspects of definitions and procedures, and describing the purpose and effects of procedures.

Although our instructed contingency's effects are somewhat complex, the instructed contingency appears to have been most helpful where most needed: for the students from the off-campus laboratory. For these students, the instructed contingency consistently enhanced attendance and preparation for lectures.

Beyond the instructed contingency enhancing attendance and preparation, of interest is whether it also increased weekly test scores. Tests determined 25% of the course grade and were primarily based on the text. Each test generally covered two chapters and included 10 short-answer questions. A few questions were directly from each chapter's learning objectives. Other questions were related to the learning objectives but tested generalization: For example, after reading about the constructional approach to goal selection, students answered: "Your dog jumps on people when they enter your home and they complain. Describe a constructional goal for a behavior change project for your dog." The tests were scored by an experienced teaching assistant. We reasoned that if the instructed contingency appeared to affect scores, then we would follow up this result with a formal analysis in which the scorer/observer would be blind to the instructed contingency and measures of interobserver agreement would be assessed.

We did not, however, find that the instructed contingency enhanced test scores. Visual inspection of test scores, plotted as in the figures above, did not reveal scores to covary with the manipulation of the instructed contingency. Indeed, the weekly test scores for each laboratory were quite variable. Sources of uncontrolled variability included text material that changed from chapter to chapter and test questions that required generalization but may not have been of equivalent "difficulty" for each test. Such variability is troublesome because our withdrawal design assessed the effects of the instructed contingency between tests. Substantial between-test variability also characterized college-classroom experiments conducted by Ryan and Hemmes (2005), but they did detect effects, perhaps, because their intervention was assessed "within tests" Researchers should consider their innovative design when conducting group analogues to single-participant designs.

Since completing these experiments, we have used the instructed contingency in the same course, but now tests included more material presented only in lecture. The later intervention has been shown to increase attendance (Lloyd et al., 1972) but it would *not* be expected to increase reading and preparing notes before lecture. With these two interventions present, we conducted two spot checks during the middle of February and two early in March of 2004. We found that on average 87% of the students from the off-campus laboratory and 94% of the students from the on-campus laboratory attended lecture. More interestingly, the corresponding percentages of students submitting notes were 83% and 88%, respectively. Put another way, 96% of the students from the off-campus laboratory and 98% of the students from the on-campus laboratory who attended lecture had read the assignment and completed notes. These high percentages indicate that the instructed contingency can support high rates of preparation outside of the context of the withdrawal design we had used. Moreover these percentages differ markedly from 30%, the typical percentage of the attending students who had reported reading assigned material when the instructed contingency had not been in effect for earlier offerings of this course.

As tuition increases and students work more hours to pay college expenses their academic behavior will likely increasingly suffer. Consequently, procedures that maintain academic behavior will become increasingly important. Procedures with some empirical support for maintaining lecture attendance include: providing information during lecture relevant to a future test (Lloyd et al., 1972), administering frequent or randomly scheduled tests (e.g., Hovell, Williams, & Semb, 1979; Lloyd, et al., 1972; Ruscio, 2001) that earn extra credit (Wilder, Flood, & Stromsnes, 2001), awarding points for attendance (Hansen, 1990; Lloyd et al., 1972), and having students "sign in" at the beginning of lecture (Shimoff & Catania, 2001). Procedures with some empirical support for maintaining class preparation include daily testing (Conner-Greene, 2000; Leeming, 2002), informing students that they will be tested on readings

(Marchant, 2000), and awarding points for completing homework that requires correctly answering test-relevant questions (Ryan & Hemmes 2005). A toolbox of procedures that support high levels of academic behavior permits instructors to match procedure with instructional circumstance. To that toolbox, we add our instructed contingency: only if a student attends lecture and submits hand-written notes for the day's reading assignment can the student use the notes during a later test. Our instructed contingency is non-punitive, inexpensive, and appears to maintain high rates of students preparing for and attending lecture.

Of course, interventions that increase learning are most desirable. In this regard, Ryan and Hemmes (2005) report their intervention to increase test scores the equivalent of about one letter grade. More effective still may be inducing students to prepare for lecture and tests by *repeatedly* testing themselves with short-answer questions as in using flash cards. Repeated testing as a means for producing learning is well supported by work in applied cognition (e.g., McDaniel, Roediger, & McDermott, 2007) and computer-based fluency training that uses precision teaching (e.g., Dermer, Lopez, & Messling, 2009). Indeed, Ryan and Hemmes (2005) noted that such a computer-based approach can tell us much about how students go about completing homework; but such an approach, because it requires repeated testing, can also enhance learning.

References

Carkenord, D. M. (1994). Motivating students to read journal articles. *Teaching of Psychology, 21,* 162-164.

Connor-Greene, P. A. (2000). Assessing and promoting student learning: Blurring the line between teaching and testing. *Teaching of Psychology, 27,* 84-88.

Choy, S. P. (2002). *Access and persistence: Findings from 10 years of longitudinal research on students*. Washington, DC: American Council on Education.

Delucchi, M., & Korgen, K. (2002). "We're the customer-we pay the tuition"; Student consumerism among undergraduate sociology majors. *Teaching Sociology, 30,* 100-107.

Dermer, M. L., Lopez, S., & Messling, III, P. A. (2009). Fluency training a writing skill: Editing for concision. *Psychological Record, 59,* 3-20.

Desrochers, M. N., Clemmons, T., Grady, M., & Justice, B. (2000). An evaluation of Simulations in Developmental Disabilities (SIDD): Instructional software that provides practice in behavioral assessment and treatment decisions. *Journal of Technology in Human Services, 17,* 15-27.

Hansen, T. L. (1990). A positive reinforcement program for controlling student absenteeism. *College Student Journal, 24,* 307-312.

Hovell, M. F., Williams, R. L., & Semb, G. (1979). Analysis of undergraduates' attendance at class meetings with and without grade-related contingencies: A contrast effect. *Journal of Educational Research, 73,* 50-53.

Leeming, F. C. (2002). The exam-a-day procedure improves performance in psychology classes. *Teaching of Psychology, 29,* 210-212.

Lloyd, K. E., Garlington, W. K., Lowry, D., Burgess, H., Euler, H. A., & Knowlton, W. R. (1972). A note on some reinforcing properties of university classes. *Journal of Applied Behavior Analysis, 5,* 151-155.

Marchant, G. J. (2000). Student reading of assigned articles: Will this be on the test? *Teaching of Psychology, 29,* 49-51.

McDaniel, M. A., Roediger, H. L., & McDermott, K. B. (2007). Generalizing test-enhanced learning from the laboratory to the classroom. *Psychonomic Bulletin & Review, 14,* 200-206.

Michael, J. (1991). A behavioral perspective on college teaching. *The Behavior Analyst, 14,* 229-239.

Ruscio, J. (2001). Administering quizzes at random to increase students' reading. *Teaching of Psychology, 28,* pp. 204-206.

Ryan, C. S., & Hemmes, N. S. (2005). Effects of the contingency for homework submission on homework submission and quiz performance in a college course. *Journal of Applied Behavior Analysis, 38,* 79-88.

Shimoff, E. & Catania, A. C. (2001). Effects of recording attendance on grades in introductory psychology. *Teaching of Psychology, 28,* 192-195.

Slish, D. F. (2005). Assessment of the use of the Jigsaw Method and active learning in non-majors, introductory biology. *Bioscene: Journal of College Biology Teaching 31,* 4- 10.

Timberlake, W. & Farmer-Dougan, V. A. (1991). Reinforcement in applied settings: Figuring out ahead of time what will work. *Psychological Bulletin, 110,* 379-391.

Vandehey, M. A., Marsh, C. M., & Diekhoff, G. M. (2005). Providing students with instructors' notes: Problems with reading, studying, and attendance. *Teaching of Psychology, 32*, 49-52.

Wilder, D. A., Flood, W. A., & Stromsnes, W. (2001). The use of random extra credit quizzes to increase student attendance. *Journal of Instructional Psychology, 28,* 117-120.

Wisneski, P. (2005). Senioritis or just spring fever? *The Ramapo Record*. Retrieved From http://www.futureofnews.com/content/ramapo/RealWorld/Story.cfm?Story_ID=737

Author Note

This report is based on the first author's master's thesis. Special thanks are due Perry Brunelli, Noah S. Dermer, Jay Moore, and Doug Woods for reviewing earlier versions of this manuscript and Shannon Lopez for tracking academic behaviors during spring 2004.

Contact Information:

Marshall Lev Dermer
Department of Psychology
University of Wisconsin-Milwaukee
P O Box 413
Milwaukee, WI 53201
Phone: 414-229-6067
E-mail: dermer@uwm.edu