# Shaping Student Behaviors Through Reward Systems: Lessons From Beaver Trapping?

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*This study examines preferences college students have for various class-related rewards and whether varying the type and schedule of student rewards is effective in shaping desired student behaviors. In an effort to improve on-time arrival in class and performance on course exams, students were offered continuous (piece-rate) rewards, a lottery system for winning extra points, and no rewards. Extra points on examinations were the most preferred rewards. The continuous reward schedule was more effective in improving student performance than the other two reward systems.*

## INTRODUCTION

The issues of student motivation and rewards have long been of interest to those who spend much of their working lives in the classroom. These topics are of special interest in the case of college classes where students who are presumably committed to learning and broadening their horizons may actually be more interested in merely earning a degree to help them secure a good job. The purpose of this paper is to present the results of a study in which rewards were used to shape desired student behaviors. The study had two parts. The first part looked at student reports on what motivates them so that the specific type of reward desired could be ascertained for use in the second study. The second part examined the effectiveness of varying the schedule of student rewards in an attempt to shape specific performance behaviors.

The quasi-experiment developed from an instructor's attempt to improve student performance in two ways. First, students had a habit of coming to class late or taking a long time to settle down and focus on the class. Socializing and tardiness were disruptive to other students and the instructor, and valuable time was lost in instruction as students took significant time to bring themselves up to speed on the subject matter and begin thinking about the course. A motivator was needed to encourage on-time performance and fast attention to the subject matter. Although negative outcomes such as locking the door to latecomers, embarrassing tardy students, or counting off points for minutes late were all available, they were frowned upon by the college and a more constructive solution was sought which would contribute to learning.

A second performance concern was that students had an overwhelming desire for multiple-choice examinations, but when they received the exams back there was much complaining that "I don't do well on multiple-choice tests." Since multiple-choice tests are so common across one's life (e.g., department-

wide exams, pilot licenses, LSAT, graduate entrance exams, even drivers' license tests), a mechanism was needed which would not only give students a check on whether they were understanding the material but also might provide some practice and feedback on how to better master multiple-choice tests.

## LITERATURE REVIEW

### Motivation and Reinforcement

We turned to the literature on motivation and reinforcement to guide us in considering variables associated with effective systems. We then examined the research focusing on classroom motivation to identify more specific considerations. Motivation, which we define here as the act of increasing the likelihood of desired behaviors, is closely related to reinforcement theory, which involves the use of rewards and punishments to shape behaviors. Motivation may be extrinsic (based on external and usually tangible rewards) or intrinsic (usually based on internal factors such as recognition, feelings of achievement, or simply the satisfaction of completing a task) (Pinder, 1984).

The implementation and success of rewarding desired behaviors is a complex one depending on a number of variables such as the size of the reward, schedule of reward, contingencies in the environment, and other factors such as gender and environmental factors, according to Lee, Sturmey, and Fields (2007). In a comprehensive review of research on reinforcement, those authors examined the research on various reinforcement conditions; they also pointed out the practical difficulties of using reinforcement in applied settings. Reinforcement requires not only the cost of the reward, but the time and attention of the monitor who must observe and administer the rewards. Some research has found that employees from different countries have different preferences on incentives and that what works in one country may not work in another (Rehu, Lusk, and Wolff, 2005), further complicating relationships among variables.

Some basic issues in motivation involve the choice of rewards themselves, usually grouped as tangibles versus recognition or intangibles. Besides the rewards themselves, the size of the reward seems to matter. For instance, offering lower quantity of rewards may actually be associated with higher performance than offering greater quantity of rewards (Ryan, Orton, & Pimm, 1968). Certain rewards may be associated with diminishing marginal returns, such that the life of the reward is limited (Rehu, et al., 2005). Similarly, Pierce, Cameron, Banko, and So (2003) found the sequencing of rewards to have an effect on motivation, such that when rewards are based on increasingly difficult standards of performance, motivation improves.

Research has also focused on the frequency and scheduling of rewards and their relation to motivation and results (Reed, 2001; Yukl, Latham, & Pursell, 1976). Rewards may be given in a continuous fashion (on a pre-determined schedule) or on a variable schedule (Skinner, 1938). The frequency with which rewards are given has been found in a number of studies to affect the probability that desired behaviors will be repeated. Yukl, Wexley, and Seymour (1972) found that workers paid on a continuous schedule of reinforcement outperformed workers on a variable schedule and that the size of the reward was of little consequence. In two subsequent studies, a continuous reinforcement schedule was found to be superior to an intermittent schedule (Yukl & Latham, 1975; Yukl, et al., 1976).

One interesting experiment looked at the conditions under which rewards were earned and the resulting productivity. Latham and Dossett (1978) looked at unionized beaver trappers in a Northeastern paper company. The beaver trappers worked first under a continuous reinforcement (straight piece-rate) system in which trappers earned a set amount for each beaver trapped and then under a variable rate system in which workers received an average (but variable) reward. These authors found that the level of experience of workers had an effect on productivity: Inexperienced workers had higher productivity under the continuous reinforcement schedule and more experienced workers had higher productivity under the variable schedule. Their results emphasize two important variables to consider when dealing with motivation: the personal characteristics of the subjects and the costs of varying reward schedules. Their research study found that employers' costs were reduced under both conditions, suggesting that the benefits of offering incentives exceed the cost of the rewards themselves and their administration.

Deslauriers and Everett (1977) extended the research on continuous versus intermittent reinforcement schedules by introducing the use of tokens as a reward for campus personnel who chose to take the campus bus in an effort to encourage use of mass transit. The tokens, granted at each occurrence in the continuous reward scenario and granted at random intervals in the variable scenario, could be redeemed for additional bus rides or for small snack items. Those authors found that this intermittent scheme was as effective as continuous scheme, and at a much lower cost. They also proposed that use of tokens (as a tangible reward) could be valuable and cost-effective as a reward to shape behavior.

**Motivation in Education**

Motivation research has been applied to the educational setting in a number of studies. Much has been written in the education literature about student goals and motivation. The studies suggest that student motivation may come from the students themselves or from the quality of the instructors or design of the delivery. Covington (2000) reviews the literature on this topic and divides student goals into academic goals and prosocial goals. The academic goals may be further differentiated as learning goals (loosely defined as high student involvement in managing his/her cognitive development by taking responsibility for learning) and performance goals (e.g., outperforming others in the classroom). Prosocial goals, in contrast, are based on feelings of being accepted and respected by others, not whether they have learned course content. Similarly, Hiller and Hietapelto (2001) stated that students often assume an orientation toward their studies that will allow them to achieve a level of performance (based on grades in the course) rather than mastery of the material. Thus, the motivation for students becomes whether or not they have earned a grade high enough to maintain their view of themselves as capable students.

The timing of performance feedback to students as well as the type of feedback (positive or negative) was found to affect student motivation for attending class and participating in extra-credit opportunities (Love, Love, & Northcraft, 2010). Later feedback (closer to the end of the semester) and more positive feedback were both found to be associated with stronger student efforts to improve their grades by taking advantage of extra credit opportunities, although the relationships were somewhat complex. Casern (2006) found that more frequent feedback (from more frequent tests and grade feedback) was more effective in boosting student performance in biology classes.

Student motivation may be based on the design and delivery of the course content as well. Sass (1989) found the most important factor for student motivation was enthusiasm of the teacher, followed in order by relevance of the material, the degree of organization and structure of the class, appropriate difficulty level, active involvement, variety, rapport between teacher and students, and use of appropriate examples. Among high school students, three core instructor behaviors for motivating students and increasing classroom success were identified. Those instructors who supported understanding, built rapport with students, and managed the classroom effectively were perceived by students to be the most motivating (Anderman, Andrzejewski, & Allen, 2011).

Other research looks at whether motivation is intrinsic (driven from within by factors such as strong desire to learn, to master the material, etc.) or extrinsic (driven by external factors such as desire to earn a degree, make more money, earn a scholarship, etc.). In a study by McEvoy (2011) M.B.A. students were found to be more extrinsically-motivated than M.S. students. Perhaps M.B.A. students are more interested in earnings potential compared with M.S. students who are more interested in the subject matter and material.

In a study concerning young math students, Freeland and Noell (1999) found that using a schedule of delayed reinforcement could motivate students to retain math concepts to almost the same degree as using a continuous reinforcement schedule. The authors pointed out that delayed reinforcement lends itself to practical advantages, in that educators may grade at convenient times and provide lean rewards.

The research on usage of rewards to reinforce desired behaviors cited above examined the effectiveness of various rewards and the schedule of those rewards. A number of those studies, however, point out the need for reinforcement that is efficient as well; that is, systems that work but also use minimal rewards and allow minimal effort to implement and sustain. Our goal in the present study was to

investigate several techniques of student motivation in hopes of identifying ways to shape student behavior at the lowest cost in terms of time and effort.

## STUDY 1: WHAT REWARDS DO STUDENTS DESIRE?

Our literature review suggested that the association between reward systems and behavior change is a complex one involving a number of factors. We attempted to put the best practices from research and theory into effect in the present study to develop and test a reward system that would be effective in shaping student behavior and performance, but would also minimize the costs of administration and contribute to learning. The overall aim was to discover a way to help students master course material and to encourage them to develop good work habits, specifically arriving on time for class.
The present study had two research questions:
1. What motivates students in college classes? Grades? Prizes? Recognition? Fear?
2. What schedule of rewards best motivates students in college classes? Is there value in a lottery-type reward system beyond a straight incentive system?

The first phase of the study was to examine specific rewards desired by students so that an effective reward choice could be made.

### Method for Study 1

Our first study was a simple descriptive analysis of tastes and preferences of students. We asked 143 undergraduate students at a large university to complete a survey during class time. All students were at least at the junior level of college and most were seniors. The students were first presented a list of 16 factors that might play a part in student motivation. Students could write in additional motivators if they desired. The items in the survey were drawn from several sources. First, literature reviews identified 10 factors that appeared in previous research about student motivation. Second, students in previous classes were asked to list as many things as they could which motivated them to study and do well in class. These were compiled and incorporated into the survey instrument. Students were asked first to rate each potential motivator on a scale from 1 = does not motivate me at all to 5 = motivates me extremely well. As a further check to differential potential motivators, students were then asked to rate the list from 1 = most important to 16 = least important, with no ties allowed, and using alternate ranking.

The second part of the survey asked the student participants to both rate and rank their preferences in a list of 12 possible incentives related to classroom performance. The purpose was to try to identify which specific classroom rewards are of most value to students.

### Results of Study 1

The results of the survey concerning what motivates students to put forth effort in a class are shown in Table 1. The findings across both rating and ranking by students were generally consistent (although not identical), so we present only the ratings here. The top three motivators all concerned grades and are examples of what Covington (2001) termed performance goals: a chance to have 10 points added to the final grade, a good grade for the course, and fear of getting a bad grade. These results indicate that students are motivated by grades and seem to be pragmatic about putting forth effort and generally support the findings of Hiller and Hietapelto (2001), who found students more interested in grades than mastery of the material. The fact that the fear of getting a bad grade was rated in the top three suggests that negative types of motivators may be almost as important as positive ones.

The next two highest-rated factors were of an intangible nature: being interested in the material and satisfaction of doing well. The factors rated lowest all concern examples of Covington's (2001) prosocial goals: fear of looking bad to the instructor, competing with other students for doing well, and fear of looking bad to other students.

The incentives they most preferred are shown in Table 2. Again, the ratings and rankings results were very similar, so we included only the rating results in Table 2. The top three again related to grades and

grading: the chance to have 5 points added to the final course grade, being allowed to exempt the final, and having 5 points added to the final examination grade. The rewards that were of least importance seemed to all relate to prosocial goals (praise from the instructor and recognition and praise from other students) or to group instead of individual rewards (pizza and snacks for the entire class).

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**Discussion of Study 1 Results**

The results of Study 1 suggest that grades do get students' attention and are rated highly by students both as motivators and as preferred rewards. Sass (1989) and Anderman, Andrzejewski, & Allen (2011) had found that variables such as student/instructor rapport and the instructor's course and content delivery played  important roles in motivating students. Although we did not include those specific variables in the present study, our findings indicate that grades could still be the most important consideration for most students. Future research should examine whether grade considerations trump course design and instructor relationship factors as rapport and teaching style. Another possible avenue for future study is the linkage between preferences for rewards and motivation and grade point averages. Do the best-performing students have different preferences than poorer-performing students?  If there are differences, it could be useful to see if there are simple and cost-effective ways to adjust rewards to target weaker students while maintaining motivators for more capable students

**TABLE 1**
**MEANS OF CLASSROOM MOTIVATION RATINGS**

| Motivation Factor | No Reward Group N = 37 | 5% Reward Group N = 26 | Lottery Group N = 80 | Overall N = 143 |
|---|---|---|---|---|
| Chance to have 10 Points added to my final grade | 5.00 (1) | 4.82 (1) | 4.77 (1) | 4.82 (1) |
| A good grade for the course | 4.57 (2) | 4.82 (1) | 4.73 (2) | 4.74 (2) |
| Fear of getting a bad grade | 4.39 (3) | 4.14 (5) | 4.23 (3) | 4.30 (3) |
| Being interested in the material | 4.13 (5) | 4.23 (4) | 3.81 (7) | 4.00 (4) |
| Satisfaction of doing well | 3.81 (10) | 4.10 (7) | 3.86 (5) | 3.92 (5) |
| Fear of failure or performing poorly | 4.00 (8) | 3.45 (13) | 3.67 (8) | 3.90 (6) |
| Pride in myself | 3.58 (14) | 4.32 (3) | 3.83 (6) | 3.89 (7) |
| Sense of achievement or accomplishment | 3.66 (12) | 3.70 (11) | 3.88 (4) | 3.87 (8) |
| Needing the material in the class for my career | 4.23 (4) | 4.39 (2) | 3.81 (7) | 3.83 (9) |
| Liking the instructor | 3.45 (15) | 3.87 (9) | 3.81 (7) | 3.76 (10) |
| Material is relevant to the 'real world' | 3.70 (11) | 4.14 (5) | 3.58 (9) | 3.76 (11) |
| My strong work ethic: I work hard at everything | 3.42 (16) | 4.05 (8) | 3.50 (10) | 3.61 (12) |
| Fear of losing financial aid | 3.81 (10) | 3.41 (15) | 3.22 (11) | 3.50 (13) |
| Fear of disappointing my family or friends | 4.09 (6) | 3.81 (10) | 3.17 (12) | 3.31 (14) |
| Love of learning | 2.94 (17) | 3.81 (10) | 2.88 (14) | 2.83 (15) |
| Fear of looking bad to the instructor | 4.06 (7) | 3.58 (12) | 2.63 (15) | 2.80 (16) |
| Competing with other students for doing well | 3.94 (9) | 4.13 (6) | 2.95 (13) | 2.78 (17) |
| Fear of looking bad to fellow students | 3.60 (13) | 3.42 (14) | 2.26 (16) | 2.21 (18) |

**TABLE 2**
**MEANS OF STANDARD RATINGS OF PREFERENCES FOR INCENTIVES**

| Incentive | No Reward Group N = 37 | 5% Reward Group N = 26 | Lottery Group N = 80 | Overall N = 143 |
|---|---|---|---|---|
| Chance to have 5 points added to my final grade | 4.69 (1) | 4.59 (2) | 4.34 (3) | 4.43 (1) |
| Being allowed to exempt the final exam | 4.00 (5) | 4.64 (1) | 4.41 (1) | 4.37 (2) |
| 5 points added to my final grade | 4.38 (2) | 4.27 (3) | 4.17 (4) | 4.23 (3) |
| Extra credit points | 4.00 (5) | 4.27 (3) | 4.36 (2) | 4.22 (4) |
| Chance to win a larger prize ($75.00 value) | 4.06 (4) | 3.91 (4) | 3.80 (5) | 3.86 (5) |
| Certificate of recognition I could attach to my resume | 4.13 (3) | 3.73 (5) | 3.76 (6) | 3.61 (6) |
| Chance to win a small prize ($25.00 value) | 3.05 (8) | 3.05 (9) | 3.11 (7) | 3.08 (7) |
| Extra points for everyone in the class | 3.50 (6) | 3.41 (6) | 2.84 (9) | 3.03 (8) |
| A day off from class | 3.19 (7) | 3.14 (8) | 2.86 (8) | 3.02 (9) |
| Praise from the instructor | 2.75 (9) | 3.23 (7) | 2.61 (10) | 2.73 (10) |
| Pizza and snacks for everyone in the class | 2.38 (10) | 2.23 (10) | 2.11 (11) | 2.22 (11) |
| Recognition and praise from other students | 2.38 (10) | 2.09 (11) | 2.00 (12) | 2.05 (12) |

## STUDY 2:  WHAT REWARD SCHEDULE WORKS BEST?

Once we identified the specific rewards most valued by students, we turned to the question of which reward schedule is most effective in shaping student behavior: no reward, a continuous reward, or a lottery or token-based reward system with an element of chance built into the system. Student learning of the material was the more important desired outcome. In every college class, it is hoped that students know more about the subject when the class is over than when they started. But the instructor also hoped to encourage on-time attendance and a quick focus on class materials. Thus, the two dependent variables where good results were desired were (1) On-time arrival in class, as evidenced by participation on a 4-item practice quiz administered at exactly the time class would start, and (2) Improvement on a pre-post assessment of knowledge of the course materials.

Research cited earlier such as the beaver trapping experiment by Latham and Dossett (1978) and Deslauriers and Everett (1977) investigated the timing of rewards and the use of tokens and delayed reinforcement. Based on inferences from these and other studies discussed in our literature review, our propositions are:

*Proposition 1: Students in the no reward group will have the lowest rate of on-time class arrival followed by students in the lottery schedule. The highest rate of on-time arrival will be in the continuous reward (5% of class grade) group.*

*Proposition 2: Students in the no reward group will have the lowest level of performance, followed by students in the lottery schedule. The highest level of performance will be in the continuous reward (5% of class grade) group.*

*Sample and Data Collection*

To address our research questions, a quasi- experimental design was used to examine outcomes under several conditions of rewards and schedules. The scenario involved three different classes over three different semesters, each under a different reinforcement arrangement. Since the same students were not involved in all three experimental conditions and since students were not randomly assigned to different conditions, this was not a true experiment. Every effort was made, however, to hold conditions as constant as possible across the three classes. The class was the same in each case (undergraduate compensation management) and the time and day were the same each semester (one day per week at 4:30). The classes were all conducted the same way with the same format and activities. The assignments and grading criteria were identical across all three groups, and the same examinations were used in all three classes. Additionally, the class sizes were very similar. Two sections had 37 and 26 students each and a third large class was split into two sections, with 40 students in each. For analysis, the two large sections were treated as one class.

*Dependent Variables in Study 2*

A four-item multiple choice practice quiz was used as a proxy for on-time class arrival. The quiz was offered to students at exactly the start time of every class. Students who were in their seats at exactly the time class was scheduled to begin were allowed to take the exam. Those arriving later were not allowed to take the quiz that day. The quiz covered material from the previous class. None of the items on the practice quiz were used in the regular tests in the class, although much of the general content was the same. Students were given exactly five minutes to complete the exam, and immediate feedback was given on correct answers. Since each item had a high point value, a very lenient grading system was used to prevent students from being discouraged: instead of 25 points each, each question was worth only 10 points, such that the lowest possible score was a 60.

The mastery of course content was measured with pre- and post-test assessment scores obtained from a different short exam. On the first day of class, a ten-item pretest was administered to all students in attendance. The ten items covered material across the whole course content. On the last day of class, the same exam was administered to all students in attendance. In both cases, the students were told that the exam grades would not count toward their actual course grades, but that they should try as hard as they could to do well. The post-test was given prior to the final examination; the correct answers to the pretest/post-test were not given to students and the exam was not discussed. The average scores on the pre-test for various classes ranged from a class average of 19.2 (out of 100 points) to a class average of 24.3. The average class score for the post-test ranged from 73.6 to 78.1.

*Independent Variables in Study 2*

The independent variables (including control variables) were: (1) The schedule and type of reward under three conditions (no tangible reward (baseline), piece-rate reward, lottery system) and (2) Grades on practice quizzes, (3) Overall GPA to date, and (4) Average grade on regular exams in the class.

The schedule and type of reward consisted of three conditions: no reward, continuous schedule, and lottery situation. Much of the research cited in our literature review found continuous rewards best in most cases, although there were exceptions (e.g., Latham & Dossett, 1978). Since the students reported in our first study that grade rewards were generally very important, we used extra points as the reward in our study. The three reward schedules are discussed in the Method section below.

The grades on practice quizzes were included as a control to examine whether student conscientious-ness as to on-time arrival had an effect on our dependent variables. It could be argued that students who are already conscientious (come to class on time, study the material, etc.) will exhibit that behavior regardless of rewards. These are most likely the intrinsically-motivated students discussed by McEvoy (2011). To control for those highly conscientious students we included the grades on the practice quizzes in our analysis.

Since some students may be better at taking multiple-choice tests than others, and since (as mentioned above) some may be much more conscientious about their studies in general, we controlled for overall

grade point average to date. Our thinking is that the more capable students will do better on the pre-post assessment anyway. GPA data were derived from official University student records, so bias from self-report information was eliminated.

Students' performance on the regular exams in the class were included as another control variable to examine whether the more capable students would do well on the pre-post assessment and are conscientious about arriving on time for class. Since both practice and regular course exams were multiple-choice format, including the average grades on the practice exams was a check on students' general ability to manage multiple choice testing.

**Method for Study 2**

In the first semester of the experiment (the baseline condition) students were told on the first day of the class that they could participate in a practice quiz at exactly the time class starts, but that those entering the classroom after the class start time would not be allowed to complete the quiz. No further information or instructions were given other than "This quiz doesn't count toward your grade, and there is no reward or punishment for taking it or not; it is up to you." We avoided using the term "practice quiz" or "practice problems" to avoid biasing students in the choice of participation. After students who wanted to participate took the quiz, the practice quizzes were collected and correct answers were given. No discussion of test taking was undertaken.

In the second semester, a continuous reinforcement schedule was used in which the practice quizzes counted 5% of the total grade in the class. The 5% was posted on the syllabus and on the first day of classes students were told about the quizzes orally and it was emphasized that they would not be able to begin the quiz if they were not in their seats at the class start time. In this case, when the graded quizzes were returned to students, the instructor discussed with the class how the multiple-choice exam questions could have been approached to enhance their probability of a good score.

In the third and last semester, a lottery-type reinforcement schedule was used. The lottery scheme was investigated in an attempt to find a reward schedule which would motivate students but one in which administration (grading, recording and tabulating grades, giving feedback) costs would be low. Of greater concern was a desire to keep from giving excessive rewards, in this case extra credit points simply for participation. In this case, students were told that the practice quizzes would not necessarily help or hurt them on the regular exams, that the practice quizzes did not count toward their final grades in the class, but that if they got two of the four practice quiz questions correct they would receive a token that would be placed into a drawing at the end of the semester for 10 points that would be added to the final course grade. Students were reminded that they could earn a token each time they were on time for the class and had 50% correct answers, so the more quizzes they took the greater their chances for earning 10 points. There would be only one drawing, so only one student would earn the extra points. It was hoped that the lottery scenario would lend some fun to the class as well. As in the case with continuous reinforcement, when the graded quizzes were returned to students, a discussion of test-taking tactics was covered as well.

**Results for Study 2**

The means and standard deviations of the variables for each group of students and the overall scores are found in Table 3. The results indicate that the highest participation rate in the quizzes (our dependent variable and a proxy for on-time arrival) was in the class where the quizzes counted 5% of the final grade (continuous reward group). While the participation rate for the combined groups was just over 70%, the rate for the continuous reward group was almost 85%. Not only were the participation rates in the quizzes higher for the continuous reward class, but their grades on the quizzes were significantly higher than those of the other groups by about 5 points, and their post-semester test score was almost 10 points higher than the other two groups.

Our results are consistent with studies we presented earlier. Like Reed (2001), Yukl, et al. (1972), and Latham and Dossett (1978), our results indicate that continuous rewards are superior to intermittent schedules and to no rewards at all.

The correlations of the variables for the combined groups are found in Table 4. Some interesting findings emerge upon examining these results. First, there is a strong positive correlation between the pretest grade and the posttest grade, as well as between the pretest and posttest scores and the final course grade. These findings suggest that strong students will do well on most any kind of test, regardless of the reward conditions. There was no significant correlation, however, between the participation on the quizzes and the final grade in the course, suggesting that good students would have done well without taking the practice quizzes. There was a significant association between participation on the quizzes and the posttest score, which suggests that the quizzes contributed somewhat to the content learning of students in the class. One possible explanation is that students became more interested in the material as the semester progressed and applied themselves to a great extent on the post-test than the pre-test.

It is interesting to note the associations of GPA with other variables. There were significant correlations between students' GPAs and participation rates on the practice quizzes. This could indicate that strong students are grade-oriented and take advantage of learning experiences and opportunities to increase their grades. There was also a strong correlation between students' GPAs and their final grade in the course, suggesting (not surprisingly) that strong students are consistent in their performance from one course to another, and that past performance is a strong predictor of future performance.

Our final analysis involved the regression of the two dependent variables on the full set of independent variables. The results for on-time arrival in class are shown in Table 5.

The analysis supported our proposition that the schedule and type of reward would vary across the quasi-experimental conditions. The effects of the grades students earned on the practice quizzes, the students' GPAs and the reward conditions were all statistically significant and positive. Thus, those with the highest GPAs also tended to be on time and make higher grades on the practice quiz.

## TABLE 3
## MEANS AND (STANDARD DEVIATIONS) OF VARIABLES IN STUDY

| Variable | No Reward Group | 5% Reward Group | Lottery Group | Overall |
|---|---|---|---|---|
| Quiz Participation | 69.44% (25.1) | **84.52% (21.4) (F = 4.36 | 67.3% (25.3) | 70.72% 25.3 |
| Pretest score | 26.3 (10.9) | 30.7 (17.0) | 28.4 (13.8) | 28.3 (13.7) |
| Posttest score | 63.3 (16.1) | *75.5 (15.2) (F = 3.35) | 65.8 (18.6) | 67.0 (17.7) |
| Difference pre/post | 37.7 (17.2) | 46.8 (15.4) | 38.7 (11.3) | 40.6 19.2 |
| Quiz Grades | 88.2 (4.1) | **92.3 (3.9) F = 4.44 | 86.0 (4.0) | 87.7 (9.0) |
| Final course grade | 79.1 (6.93) | 81.1 (7.1) | 81.3 (6.9) | 80.0 (6.8) |
| GPA | 2.98 (0.28) | 3.11 (0.41) | 3.06 (0.35) | 3.05 (0.35) |

*p<0.05        **P<0.01

**TABLE 4**
**CORRELATIONS OF VARIABLES FOR COMBINED GROUPS**

| Variable | (1) | 92) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Pretest grade | --- | | | | | |
| Posttest grade | 0.31** | --- | | | | |
| Difference score | -0.41** | 0.74** | --- | | | |
| % Quizzes taken | 0.04 | 0.21* | 0.06 | --- | | |
| Course grade | 0.17* | 0.37** | 0.19* | 0.13 | --- | |
| GPA | 0.04 | 0.17 | 0.09 | 0.18* | 0.30** | --- |

N = 137        ** p <0.01        *p< 0.05

The results for improvement on the pretest-posttest assessments were generally not supportive of our proposition that students who participated in the practice quizzes (and thus arrived on time) would have the greatest difference in the pre- and post-test scores (improvement). These results are shown in Table 6.

The students' GPAs were again significantly related to improvement and in a positive direction. Of lesser significance were the grades on the practice quizzes. Did the practice quizzes (and on-time arrival) improve content learning in the classes? The results in Table 6 indicate that there were no significant differences in pre and post-test improvement, but that (consistent with the results in Table 5) the students with higher GPA's learned more than those with lower GPA's.

**Discussion for Study 2**

Our research studies have examined some relationships and conditions that have practical value for those in the classroom. Some conclusions are clear from both studies and are consistent with each other. First, college students are very grade-oriented, and they are motivated perhaps more strongly by grades than any other factor. They value grades as rewards and do not seem care much for social or team rewards. And using grades to shape their behaviors (as in the case of making the practice quizzes part of the final course grade) is highly effective. Second, additional opportunities are effective in increasing content learning, but the students most likely to take advantage of them will be students who do well in all their classes, regardless of rewards or schedules.

We had hoped to shed some light on ways to increase student learning by introducing a lottery approach to classroom rewards that would inject some fun into the class, shape on-time behavior in a positive way, and provide a low-cost way to reward students. Our results, however, indicated that the lottery option was no better than the control group (no reward) in increasing mastery of course content and shaping on-time behavior. This is in contrast to the study of bus riders by Deslauriers and Everett (1977) who had found the use of tokens in an intermittent reward scenario to be effective. Apparently the results from bus ridership do not generalize well to classrooms

**TABLE 5**
**REGRESSION RESULTS FOR COMBINED CLASSES**

| Independent variable | Unstandardized B | Standard error | Beta | t | Significance |
|---|---|---|---|---|---|
| Grade on quizzes | 0.561 | 0.23 | 0.22 | 2.49 | 0.014 |
| Course grade | 0.08 | 0.32 | 0.02 | 0.25 | 0.802 |
| GPA | 12.48 | 6.10 | 0.18 | 2.05 | 0.043 |
| Reward group | -5.4 | 2.61 | -0.18 | -2.07 | 0.040 |
| (Constant) | -8.58 | 30.20 | | -0.28 | 0.78 |

N = 132
Dependent variable: On-time arrival in class
R-square = 0.146 (Adjusted R-square = 0.120)
F = 5.484 (P < 0.000)

**TABLE 6**
**REGRESSION RESULTS FOR COMBINED CLASSES**

| Independent variable | Unstandardized B | Standard error | Beta | t | Significance |
|---|---|---|---|---|---|
| Grade on quizzes | 0.364 | 0.20 | 0.19 | 1.86 | 0.066 |
| Course grade | 0.49 | 0.31 | 0.17 | 1.573 | 0.119 |
| GPA | 12.48 | 6.10 | 0.18 | 2.05 | 0.043 |
| Reward group | -0.054 | 5.77 | -0.01 | -0.09 | 0.926 |
| (Constant) | -28.14 | 27.77 | | -0.87 | 0.387 |

N = 132
Dependent variable: Improvement in pretest-posttest scores
R-square = 0.087 (Adjusted R-square = 0.051)
F = 2.385 (P < 0.056)

The strong associations among on-time arrival, performance on the practice quizzes, and GPA indicates that there may be a "type" of student who is conscientious and will do well regardless of grading or classroom practices. The fact that students with high GPAs significantly improved their knowledge of course content is especially interesting. The findings suggest that students with higher GPAs enter the class with about the same level of knowledge about the course content as students with lower GPAs, but that over the course of the semester they outperform lower-GPA students. They also were more likely to arrive on time and take the practice quiz, but it was not possible in the present study to determine whether their superior class performance was due to effects of personality type (conscientiousness) or to taking the quizzes. Our findings may indicate that student capability and intrinsic motivation may be more important than classroom conditions or reward systems.

What are the practical lessons for instructors? Our findings suggest that concentrating on using grades to shape behavior and motivate learning may be the most efficient use of instructors' time and effort. Extrinsic rewards beyond grades had little effect on student learning and may have been a poor use of the instructor's time and effort. Although no formal measures of student satisfaction with the practice tests were obtained, informal feedback from classes showed tepid student interest in the practice.

## LIMITATIONS

This study had among-subject variances since the same students were not in all three experiment conditions. This is a major problem. But the day and time of the class was the same each semester, so hopefully we addressed possibilities such as evening students being more motivated than day students, more seniors taking the class (and thus simply eager to finish college, since at this point the overall GPA was unlikely to change much), or fewer majors taking the course.

It could be argued that 5% is not much of a reward for the continuous schedule group. Future research could vary the grade criteria to investigate whether the size of the reward has an impact on behavior change. We also did not examine the timing of the rewards. In the lottery scenario, the reward did not come until the end of the semester, although the receipt of tokens throughout the semester could be seen as continuous rewards. One interesting variation might be to hold tokens or credits for the lottery until the end of the semester to see whether behavior is affected.

It would be interesting to see if the results generalize to other schools. Our university is highly diverse with about one-third of students white, one-third African-American, and one-third others (primarily Asian). While about 50% of students live on campus and more in the local area, many are full-time employees (many with families) who commute to campus on a part-time or full-time basis. The results could well be different for colleges where more traditional students are the norm.

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