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The Effect of Daily Quizzes on Hour Examination Performance in a Junior Level Psychology Course

Rose Marie Hesse

Western Michigan University

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THE EFFECT OF DAILY QUIZZES ON HOUR EXAMINATION PERFORMANCE IN A JUNIOR LEVEL PSYCHOLOGY COURSE

by

Rose Marie Hesse

A Thesis
Submitted to the Faculty of The Graduate College in partial fulfillment of the Degree of Master of Arts

Western Michigan University
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Rose Marie Hesse
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EXPERIMENT I

A behavioral approach to education introduced by Keller (1968) stresses self-pacing by the student, a mastery criterion on unit tests, optional lectures and demonstrations for purposes of motivation, emphasis on textual material and the use of proctors as features of a new educational technology. This technique has been applied to various introductory psychology courses (Malott and Svinicki, 1969; Janczarek, 1970; McMichael and Corey, 1969; Sheppard and MacDermot, 1970) and lower level undergraduate psychology courses (Lloyd, 1969; Witters and Kent, 1970; Nelson, 1971). The self-pacing, or Keller, plan has also been used in teaching other areas including sociology, cultural anthropology, religions of the world (Witters and Kent, 1970) and introductory statistics (Myers, 1970).

Michael (1969) has described the management of behavior in education at all levels in terms of the identification of goals, contingencies, and consequences. Numerous studies involving new educational systems have been done on all levels, elementary (Lovitt and Curtiss, 1969) through college level instruction.

Most college level studies have dealt with freshman or sophomore level students or with an introductory level of material. The present study was based on a junior level psychology course. Janczarek (1970) and Malott and Palm (1970) described an introductory course utilizing daily quizzing with the use of objective multiple-choice questions. The present study also utilized daily quizzing, but used short-answer essay
questions and also involved a remedial system every other day based on average class performance. No self-pacing or interviewing techniques were used, but student teaching apprentices were available to the student to answer questions. The Janczarek (1970) study achieved statistical significance but did not achieve practical significance. Thus one of the goals of the present study was to achieve practical as well as statistical significance in studying the effectiveness and influence of daily quizzes on hour examination performance in a junior level psychology course.
METHOD

Course Design

The daily quizzes in this study consisted of ten-point short-answer essay quizzes. The first quiz on an assignment sampled all of the objectives or study guide questions. Those objectives on which the class as a whole obtained 90% accuracy or better were dropped from the assigned material and the next day's remedial quiz was based upon those objectives below 90% accuracy. Thus remedial quizzes on a given assignment were repeated until all of the objectives were mastered to criterion or the number of remaining objectives was judged small enough, in which case those objectives not yet remediated were included in the new assignment. The usual amount of time spent per assignment was two or three days. The objective numbers and percentages obtained for the entire semester were recorded on a large table from which the number of times each objective had been presented, the date of each presentation and the percentages obtained were easily obtained.

Those students who achieved a score of ten were not required to attend any of the remedial quizzes given over that assignment. Those students who did not achieve a ten on the first quiz were required to attend and take the remedial quizzes until either they achieved a ten or a new assignment was given. The student was given an automatic score of ten for the remedial quizzes that he was not required to take.

A brief question and answer period of up to five minutes duration began the period, and the quiz followed for the first 20 minutes of the
period. The remaining portion of the one hour class period was spent in laboratory work.

Subjects

During the Fall semester of 1970, students enrolled in Psychology 350: Behavior Analysis I volunteered to participate in this study. All students were given an explanation of the experiment and were asked to apply for participation. From the list of volunteers, students were randomly assigned to one of two experimental groups. A total of 33 students volunteered and participated in the experiment with 16 students in one group, designated exam group and 17 in the other, designated quiz group. All students not volunteering to participate were designated the regular group. The regular group engaged in the same activities as did the quiz group and provided a means of comparison as to the generality of the results. Eight students withdrew from the course before the end of the term, three in the exam group and five in the quiz group.

Those students in the exam group were guaranteed a grading scale for the exams to compensate for any differences that might occur. It was felt that this would not constitute a serious problem in the performance of these students since the student would still be required to perform to some minimum, although unspecified, criterion. The exam group students were exempt from attending or taking the daily quizzes, but were required to attend the laboratory portion of the course, five days a week.
Procedure

The manner in which the course material was presented was the main independent variable, and the dependent variable was performance on the midterm and final examinations.

The text material was *Principles of Behavioral Analysis* (J.R. Millenson, 1967). Each student was provided with a set of objectives or study guides. Any supplementary or clarifying materials developed throughout the term were distributed to all students. In addition a set of questions and answers for the quiz of the preceding day was distributed daily to all students.

The midterm and final exams consisted of one half of the final course grade for all students. The exam group was required to attend the laboratory portion of class daily, but were not required to attend or to take the quizzes. The other one half of the course grade for this group was made up of the laboratory work.

The quiz group and the regular group attended a quiz session daily, Monday through Friday, and took a ten point, short-answer essay quiz. All of these students took part in remedial activity on those objectives on which the class collectively obtained less than 90% accuracy. Any given objective was then presented until the class had achieved 90% accuracy. The other one half of the course grade for these students was comprised of the daily quizzes and of the laboratory work.

The grading scales for the exams were determined by a decision by the instructor upon a "reasonable" scale for the quiz and regular groups based on the results of the exams. The scale was then adjusted so that
the exam group would obtain the same percentages at each grade level for the course grade. The criterion for each portion of the other one half of the course grade was 90% of total possible points in each portion for an "A" level of work.

The midterm exam consisted of 25 multiple choice and true-false questions, and 15 short-answer essay questions. The final exam consisted of 25 short-answer essay questions. Sample questions may be found in Appendix I. All questions on both exams were directly correlated with the objectives or study questions. In many cases the question was a paraphrase of the objective itself. All questions on both the midterm and final exams were taken from only those objectives on which the class had achieved 90% accuracy during the semester, thus insuring that no bias was introduced by the introduction of unfamiliar material on the exams.

Approximately two thirds of the course text was mastered during the semester. Each assignment covered five to ten pages with ten to twenty objectives on each assignment.
RESULTS

The distribution of the exam scores for each group on the midterm exam appears in Fig. 1. No visible difference in the distributions appears between the quiz and regular groups who engaged in the same course activities, thus substantiating the generality of the effect of this treatment. The difference in means of the exam group (56.94) and the quiz group (75.83) results in a \( t \)-value of 3.01, significant at the .05 level of confidence. At this time no students had withdrawn from the course in the exam group, but there were five students who withdrew from the course in the quiz group, resulting in unequal sizes for the two groups. It was felt that perhaps those students in the exam group who would ordinarily have withdrawn, may not have done so due to the fact that they had not had their performance sampled to that point in the course and due to the guarantee of compensation on the examinations. Therefore the bottom four scores in the exam group were eliminated and the \( t \)-value was found to be 2.08, also significant at the .05 level.

The distribution of the exam scores for each group on the final exam appears in Fig. 2. The difference in means for the exam group (50.00) and the quiz group (65.00) results in a \( t \)-value of 1.68, not significant at the .05 level. However, we must note that the actual difference in means were similar (15% and 19%) on both midterm and final, but the number of subjects was reduced for the final.

The correlation between the percent score on daily quizzes and the final exam scores for both the quiz group and the regular group is
Figure 1. Distribution of exam scores for each group on midterm exam.
PSYCHOLOGY 350  
FALL 1970

regular group  n=27

quiz group  n=12

exam group  n=16

PERCENT OF STUDENTS

10 20 30 40 50 60 70 80 90 100

MIDTERM EXAM (percent correct)

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Figure 2. Distribution of exam scores for each group on final exam.
PERCENT OF STUDENTS

PSYCHOLOGY 350
FALL 1970

regular group
n=27

quiz group
n=12

exam group
n=13

FINAL EXAM (percent correct)
presented in Fig. 3. The correlation coefficients were computed for both the midterm and final exams pooling the data from the quiz and regular groups. Both correlation coefficients were shown to be significant at the .01 level ($r = .451$ for the midterm, $r = .512$ for the final).
Figure 3. Correlation between percent score on daily quizzes and final exam scores for Quiz and Regular groups.
PSYCHOLOGY 350
FALL 1970

- regular
- quiz
DISCUSSION

The data presented here demonstrate that the use of daily quizzing techniques produced a statistically significant difference between two groups of students on the midterm exam and did not produce a significant difference on the final exam. The actual difference in means, 19% on the midterm and 15% on the final, is equal in both cases to more than one letter grade. This is greater than the difference found by Janczarek (1970) who indicated that since her results showed only a 4% actual difference, the practical significance of the method remained in doubt. The larger difference in the present study seems to indicate a practical difference.

The failure of the final exam to achieve statistical significance may be due to the large variability and the small sample sizes. A replication of sorts was done the following semester, however with many procedural changes. That study used a larger sample size and obtained significant results, thus suggesting that the small number of subjects in this study may be the reason for the lack of significance on the final exam.

A potential criticism of this study is that the exam group did not do well on the exams for the reason that they were not required to do as well as the quiz group was. They may not have been attempting to do as well and the difference found was due to this fact. Countering this argument is the fact that the exam group student was competing only with his own group on the exams with no prior knowledge as to the criterion for the exams, or as to how well he would have to do in order to be
included in the percent of students who received an "A". Thus there would seem to be sufficient impetus for the exam group student to attempt to obtain the highest score as he could on the examinations.
CONCLUSION

This study has shown that a significant difference was obtained on a midterm exam but was not obtained on a final exam. However, the large actual difference in means indicated a practical difference. The failure of the final exam to achieve statistical significance was discussed in terms of the large variability and the small sample sizes.
EXPERIMENT II

In the previous study, the grading scales on the exam for each group were not the same, thus introducing a potential confounding variable. In the present study an absolute grading scale requirement (80%) was instituted for both the quiz and exam groups in an attempt to eliminate this variable.
Course Design

In the present study the number of quizzes per assignment was limited to two, the original quiz and the remedial quiz. A single assignment or unit was worth 10 points toward the total quiz point score for the course. The two quizzes given over each assignment, each assignment being worth 10 points, utilized short-answer essay questions. A student who received a nine or ten on the original quiz was not required to attend or take the remedial quiz held on the following day, and received his score for the unit on the basis of the original quiz. Those students who received below a nine were required to attend and to take the remedial quiz on the following day and the highest score of the two quizzes was recorded as the score for the unit.

Under this system, theoretically the student could have not prepared for the original quiz and prepared for the remedial quiz only. In order to combat this potential problem and to ensure that the student prepared at least minimally for the original quiz, a sliding scale of penalties was instituted for below minimal performance on the original quiz as follows:

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<th>Penalty</th>
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<tbody>
<tr>
<td>10</td>
<td>no penalty</td>
</tr>
<tr>
<td>9</td>
<td>no penalty</td>
</tr>
<tr>
<td>8</td>
<td>no penalty</td>
</tr>
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<td>3 point penalty</td>
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<tr>
<td>3</td>
<td>4 point penalty</td>
</tr>
<tr>
<td>2</td>
<td>5 point penalty</td>
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</table>
The penalty points were deducted from the highest of the two quiz scores for the unit.

The first quiz sampled all of the objectives or study guides of the assignment and the second quiz covered only those objectives on which 90% accuracy was not achieved. The percentages were recorded on a table in the same manner as the previous study.

In contrast to the previous study in which the students took the quiz during the first 15 minutes of the class period, the students, in this study, studied in booths in a study center for 45 minutes and then took the quiz during the last 15 minutes of the quiz portion of the period. The 60 minute laboratory portion followed the quiz. In addition, a required 100 minute lecture and a 10 minute quiz was given one evening a week for the purpose of clarifying objectives and adding supplementary material.

Subjects

During the Winter semester of 1971, students enrolled in Psychology 350: Behavior Analysis I volunteered to participate in this study. Those students who volunteered were guaranteed a lower grading criterion for the examinations (80% as opposed to 90%). The exam group students were exempt from attending and taking the daily quiz portion of the class during the first hour of the scheduled two hour class session.

All students were given an explanation of the experiment and were asked to apply for participation. From the list of volunteers, students were ranked according to an entrance exam score (Psychology 150 final
exam) and were randomly assigned in pairs to one of two experimental groups. A total of 44 students volunteered and participated in the experiment with 22 students in each group, designated exam group and quiz group. The 21 students who did not participate in this study were designated regular group. Five students in this study withdrew from the course before the end of the semester, two in the exam group and three in the quiz group.

Procedure

The same independent and dependent variables were used and the course materials were the same as in the previous study. All course materials were presented in the same manner as in the previous study.

A 90% criterion of the total points earned on all daily activities made up a "B" level of work for all students. A 90% score on the average of the midterm and final exams raised the letter grade of the regular group to an "A" level of work for the course. For all students who volunteered, the quiz and exam groups, this criterion was reduced to 80%.

The laboratory work alone comprised the daily activity of the exam group. The quiz and regular groups attended a quiz session daily, one hour before the laboratory, Monday through Friday, and took a ten point, short-answer essay quiz. For the quiz group and the regular group, the daily activities were the laboratory work and the daily quizzes.

The grading scales for the exams were on an absolute basis, 90% for an "A" for the regular group and 80% for the quiz and regular groups. These scales were lowered after the results of the midterm to 85% and 75% respectively. Two days before the final it was announced that any
student who obtained an "A" on the final would be given credit for an increase in grade by one level ("B" to "A", "C" to "B") regardless of the midterm score. This was done for two reasons. Many of the students who had been taking the daily quizzes at that point were not able to achieve an "A" in the course due to the midterm scores, even with an "A" on the final, and this was also the case with many of the students in the exam group. Thus it was felt that this contingency would offer the student the proper motivation to do well on the final exam.

The midterm exam consisted of 21 short-answer essay question and the final consisted of 20 short-answer essay questions. The questions were similar to those in the previous study. On both exams 60% of the questions were paraphrased directly from the objectives and 40% were new questions combining several objectives. Again all questions on both midterm and final exams were taken from only those objectives on which the class had obtained 90% accuracy.

Approximately three fourths of the course text was mastered during the semester. The assignment length and number of objectives remained the same.
RESULTS

The distribution of the exam scores for each group on the midterm exam appears in Fig. 4. Again the distribution of scores of the regular group seems to substantiate the generality of the results of the quiz group's distribution. The difference in means of the exam group (59.45) and the quiz group (77.05) results in a $t$-value of 2.95, significant at the .05 level. At this time two students had withdrawn from the course in the exam group and three had withdrawn in the quiz group. Eliminating the bottom student in the exam group, the difference in means resulted in a $t$-value of 2.72, still significant at the .05 level.

The distribution of the exam scores for each group on the final exam appears in Fig. 5. The difference in means of the exam group (40.90) and the quiz group (64.36) results in a $t$-value of 2.66, significant at the .05 level. The number of students who withdrew from the course remained the same and eliminating the bottom student, the difference in means resulted in a $t$-value of 2.42, still significant at the .05 level.

The correlation between the percent score on daily quizzes and the final exam scores for both groups taking quizzes is presented in Fig. 6. Both correlation coefficients were shown to be statistically significant at the .01 level of significance ($r = .498$ for the midterm, $r = .503$ for the final).
Figure 4. Distribution of exam scores for each group on midterm exam.
PSYCHOLOGY 350
WINTER 1971

regular group
n=17

quiz group
n=19

exam group
n=20

PERCENT OF STUDENTS

MIDTERM SCORES (percent correct)
Figure 5. Distribution of exam scores for each group on final exam.
PSYCHOLOGY 350
WINTER 1971

regular group
n=17

quiz group
n=19

dexam group
n=20

FINAL SCORES (percent correct)
Figure 6. Correlation between percent score on daily quizzes and final exam scores for Quiz and Regular groups.
PSYCHOLOGY 350
WINTER 1971

FINAL EXAM SCORES

PERCENT ON DAILY QUIZZES

○ regular
× quiz
DISCUSSION

The data presented in this study also seem to demonstrate that the use of daily quizzing techniques produces both statistically and practically significant differences. However, due to its complexity, this study has one flaw. Both experimental groups were under the same absolute grading scale for the examinations. Both were required to obtain 80% on the average of the exams in order to raise their course grade from a "B" to an "A". The "B" grade was based upon each group's daily activities. The quiz group's grade of "B" consisted of obtaining a 90% criterion on the daily quiz score plus the laboratory scores. The exam group's grade of "B" consisted of obtaining a criterion of 90% on the laboratory scores only. At the beginning of the study it was not foreseen that almost all of the exam group students would obtain the 90% criterion on the laboratory work. This meant that the reward to the exam group student for performing well enough on the examinations to get an "A" when it was relatively easy to obtain a "B" without ever reading the quiz material, was unclear or could not be guaranteed experimentally. After the midterm exam, the fact that the reward for performing well was not clear was evident and motivational contingencies (e.g. lowered grade scale for the midterm and the announcement prior to the final) were added in an attempt to rectify this fault.

It could be argued that if enough of the exam group students did not attempt to do well on the exams despite the additional motivational contingencies, it would not be surprising that statistically significant differences were obtained on the exams. However the results of a
questionnaire given prior to the final exam indicated, through several questions asking what grade the student expected and what the status of the student was at various times in the course, that the exam group students were as motivated to do well on both exams as were the quiz group students.

Changes in Experimental Design

While it seems desirable to perform exact manipulations and place strict controls on an experiment of this type, often it is difficult or impossible to do so. There are variables over which the instructor has little or no control. Many of these are extremely complex and it is difficult to foresee their effects on the experimental and educational situation.

Most experiments in education have flaws of one sort or another. The experimentally tight situation may have rather unpleasant aspects to the student, or the looser situation may leave room for confounding variables. In the second study it is obviously desirable to have as similar contingencies and criteria as possible for both groups. Seemingly this was achieved in this study. However, a problem arose in that for the exam group the payoff for reading the text material was, at best, an increase of only one letter grade. It seems that two changes are possible: a change in the criterion of the course or a change in the contingencies of the course.

The purpose of maintaining equal criteria on the examinations in the second study was to eliminate the possibility of unequal motivation of the two groups to perform well. It, then, would be self-defeating to change
the criterion of the course. Thus the criteria of 90% on the daily activities of quizzes and laboratory, and 80% for the quiz and exam groups and 90% for the regular group on the exams, would be unchanged.

It seems that a change in the contingencies of the course would be the most desirable route. The contingencies of a "B" for the daily work and an increased grade to an "A" for the examinations would, then, be subject to change. One possible change would be to give an "A" for the daily work and decrease the grade according to the examination performance, 70-80% resulting in a "B", 60-70% resulting in a "C", 50-60% resulting in a "D", and below 50% resulting in a failing grade. However this system would seem to have rather unpleasant aspects for the student and has been found to be extremely unpopular among students in previous semesters of the course, although it would effectively solve the problem.

Another change would be to give a lower grade, a "C" or "D" perhaps, for the daily work and an increase in grade would be earned by reaching a set criterion on the examinations. This seems a little less aversive to the student, but would not seem to generate the motivation that the previous system does. Either of the two systems would solve the problem, but each has drawbacks and these would have to be weighed carefully before a decision could be made.

Changes in Course Design

As the course existed in Winter semester of 1971, many complex contingencies were in effect. Many of them so complex as to be confusing to both the student and to the teaching apprentice. While the system was a workable one and seemed to generate fewer aversive properties and
higher quiz scores than had been the case with the course in the past, it was more stringent and had more aversive properties than seem necessary. First, the mere complexity of the course seemed to have some aversive properties. A few students never understood the quiz point system and penalties. Many students found the absence and makeup policies aversive. Others found that the assignment schedule was too slow or too fast, or disliked daily quizzes and wished for fewer quizzes and slightly longer assignments. All of this is not meant to denigrate the course, for the course was evaluated as valuable and a rewarding educational experience in the course evaluation given at the end of the course.

However, it seems feasible that an advanced course limited to 80 students has a great deal of freedom in course design. And assuming a somewhat advanced student, it seems possible to loosen the tight contingencies on attendance and the quiz system. A completely self-paced system has disadvantages, both for the instructor and the student. The student tends to procrastinate and the instructor must be prepared to cope with a large portion of the course work being completed near the end of the semester. On the other hand a tightly controlled daily situation must compete with the various social activities available to the student, emotional upsets, minor ill health, and other such variables. However some form of self-pacing seems possible and perhaps desirable in this course. Since a study center has been set up with booths convenient for studying and quiz taking, it seems that a self-pacing system could be implemented easily.

A possible arrangement involves the student in contracting the
schedule of quizzes with the instructor or teaching assistant. A limited number of options are given the student, such as a 10-15 minute quiz daily, a 15-20 minute quiz every other day, a 30 minute quiz weekly, a 45 minute quiz every other week, and an hour quiz every three weeks. The student contracts for a minimum of one week at a time and the teaching apprentice grades each quiz individually immediately after the student takes it. Remedial quizzes would be available at specified times according to the schedule the student chose. The study center would be open certain hours of the day and the quizzes available at the beginning of each hour from any of the teaching apprentices on duty, although each student would be assigned to a particular teaching apprentice permanently. While such a design is feasible, it seems to be a rather complex and confusing design for the instructor to implement and monitor. A similar, but simpler system would be to offer an arrangement in which a certain number of units were assigned for the semester. These units would be self-paced with an escape contingency every third week. Every third week an hour exam would be offered from which the student could escape if he had completed the specified units. The student would also have the option of not completing the specified units if he obtained a 90% criterion on the hour exam. If he obtained less than 90%, he would be required to complete the units covered on the exam. Such an arrangement would discourage the student from procrastinating and yet allow him to move through the material as fast as he wished. Each unit would be mastered to criterion before another unit would be begun and limits may be set on the number of units that may be completed in one day at the discretion of the instructor. Remedial quizzes would be available upon
demand of the student for the units, but no remedial hour exams would be given. The teaching apprentice again would be assigned a certain number of students and would grade the quizzes immediately. This is a simple easy-to-understand system and seems to eliminate the complaints about attendance policies, assignment schedules, and quiz schedules. It would be relatively simple to administer since only five or six forms of the quiz for each unit and the five hour exams would be required. No extra staff would be required and a more rewarding relationship between teaching apprentice and student would be possible in the one to one relationship at the time of grading.
CONCLUSION

This study has shown that both a statistical and a practical difference was obtained on both a midterm and a final examination. Changes in the experimental design of the study and changes in the design of the course were discussed in terms of the flaws that were present in the study.
REFERENCES


APPENDIX I

Sample Questions From Fall 1970 Midterm

Multiple-choice and True-false

--If the $S_D$ rate was 150 and the S-delta rate was 200, what is the value of the $I_q$?

A. 0.57  
B. 0.43  
C. 0.75  
D. 1.00

--In the above question, what does the answer show?

A. almost perfect generalization, little discrimination  
B. almost perfect discrimination, little generalization  
C. rate preference for S-delta  
D. perfect discrimination, no generalization

--If you had a yellow $S_D$ and a green S-delta and a large amount of reinforcement and we drew a gradient depicting this, that gradient would show the amount of responding that could occur to the S-delta due to the effects of generalization.

True or False

--A conjunctive concept involves the lack of a single obvious common relation.

True or False

Essay

--Suppose you had trained a subject with CRF on one wavelength, and ran a generalization test. During your gen test the responses were extinguished to nearly operant level. How would you prevent this?

--Give the paradigm of an "L" set.

--Define response cost.

--Give 2 behavioral methods used to study "similarity".

--What is the basic operation for establishing a discrimination?
Sample Questions From Fall 1970 Final

--What is the difference between a DRH schedule and a FR schedule?

--Give the paradigm of operant strengthening and of operant extinction.

--Draw cumulative records showing typical performance on the following schedules: FR, FI, VI, DRL, and CRF.

--Define generalized reinforcer.

--Construct a flow diagram (using the operation boxes and test boxes) using the following problem: First a rat must pull a chain. If a light goes on, he may press a lever and receive reinforcement. If the light does not go on, he must wait 5 sec. and pull the chain again.

Sample Questions From Winter 1971 Midterm

--Give an original example of response generalization.

--How many behaviors (respondent) can a single conditioned stimulus (CS) elicit? Why?

--What is a behavioral process?

--What are positive acceleration and negative acceleration? Draw an example of each (cum record).

Sample Questions From Winter 1971 Final

--Give a graphic representation of the threshold of hearing for humans.

--Millenson presents the idea that the extinction process is due mainly to a gradual increase in the number of inactive periods over time. What data is there to support this?

--Define shaping or successive approximations.

--Using green as your training stimulus, and blue, yellow and red as other stimuli, construct an experiment to show stimulus generalization. (procedure)

Construct a graphical representation of the results of your experiment.