Daily Quizzes with Review and Rededial Quizzes and Examination Performance

Mary Collamer Hubbard

Western Michigan University

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ACKNOWLEDGMENTS

I express my sincere appreciation to Dr. Richard Malott for his encouragement, advice, and supervision during the course of this study and in the writing of this thesis. I also appreciate the criticisms and comments given by the members of my committee, Dr. Jack Michael, Dr. David Lyon, and Dr. Rudolf Siebert.

I thank Mr. Robert Hubbard for his time and skill in preparing this manuscript for submission to the graduate School. For the intellectual training and financial aid of an Assistantship during my graduate career, I am grateful to the faculty of the Psychology Department.
HUBBARD, Mary Collamer

DAILY QUIZZES WITH REVIEW AND REMEDIAL QUIZZES AND EXAMINATION PERFORMANCE.

Western Michigan University, M.A., 1971
Psychology, experimental

University Microfilms, A XEROX Company, Ann Arbor, Michigan
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Much psychological literature refers to the application of behavior-modification techniques in educational settings. Emphasis has been placed on short study units, immediate feedback, texts with built-in reinforcers, supplementary objectives, and explanatory or motivational lectures (Keller, 1968; Witters and Kent, 1970; and Michael, 1971).

Much of this interest in the use of behavioral techniques can be traced to Keller (1968) who used self-paced instruction and cumulative unit test mastery in a study at Arizona State University. Keller's students, who played an active part in acquiring educational repertoires, were required to master each successive unit before advancing to new material, paced their own rate of study behavior, and received immediate feedback regarding their understanding of course material. Advanced students, serving as proctors, interacted with beginning students in a face-to-face learning situation.

Building upon Keller's research, Malott and Svinicki (1969) applied similar behavioral techniques in an introductory psychology course at Western Michigan University. Techniques used in the course included close supervision, small study units, supplementary objectives, individualized remediation, and immediate feedback.
The use of these techniques has also been stressed by Michael (1971) who sees them as of prime importance in the educational process.

The educational value of immediate feedback has been demonstrated in various ways. The following are typical examples: the use of programmed texts (Skinner, 1962), the immediate grading of tests and reporting of scores (McMichael and Corey, 1969; Myers, 1970), the use of interviews (Sheppard and MacDermot, 1970), and the use of supplementary objectives that reinforce correct versus incorrect responses where conventional texts do not (Keller, 1968; Janczarek and Malott, 1969; and Malott, Psychology 150 and Friends, 1970 and 1971).

Of particular interest to the present study is research reported by Janczarek (1970). She used 185 students, separating them into two groups, a Quiz group and an Exam group. Her study was designed to test the hypothesis that daily quizzes improve examination performance. The hypothesis was confirmed. The improved examination performance of the Quiz group was shown to be statistically significant at the .01 level of confidence. The practical significance of the study was not dramatically obvious. The actual point difference between the means of the Exam and the Quiz groups was 4%. This difference was not large enough to be reflected in
an appreciable rise in the letter grades of the students in the Quiz group. Janczarek reported, "The mean score out of a possible of 90 points (mid-term plus final minus bonus points) was 62.7 (69%) for the Exam group and 66.3 (73.6%) for the Quiz group." The fact that the practical significance was not immediately obvious suggested the need for further refinements in the educational techniques used in the Janczarek study.
INTRODUCTION I

On reviewing Janczarek's study, it was believed that further improvement could be achieved in the test scores of the Quiz group by specific changes in the educational design. It was hypothesized that, through changes in the quiz procedure, in the study objectives, and in the materials used, the practical level of significance could be raised. Accordingly, in the fall of 1970 the present study was begun.

The differences between the present study and the Janczarek study were as follows: In the early program, make-up quizzes were given in special sections outside of the scheduled class periods; in the present program, remedial quizzes were given during scheduled class periods. In the former study, only those students who failed daily quizzes were given make-up quizzes; in the present study, all students were given remedial quizzes over objectives failed by 10% or more of the students. (Hereafter these objectives will be referred to as problem objectives.) Problem objectives were included on assignments and given on quizzes until 90% of the students passed them. In the Janczarek study, the entire unit of assigned material was repeated on the make-up quizzes; in the present study, only those objectives that
10% or more of the students had failed were repeated. These problem objectives were identified for the students by the use of hand-outs that specified the exact objectives to be included on the quizzes.

For the present study, the review system was also modified. In the early study, review quizzes were given infrequently; in the present study, review quizzes were programmed to appear throughout the semester. In the fall study, one review quiz, one remedial, and two quizzes over two chapters of new material were given every week; in the winter study, the review and remedial quizzes were given in blocks of approximately four every other week, alternating with a week of about four quizzes over four chapters of new material.

The format of the study objectives was changed to multiple-choice so that they would be in keeping with the multiple-choice quiz and exam questions. This was done to minimize any misunderstandings students might have in regards to what was expected of them.

The test questions used in the present program were more closely related to study objectives than those used in the earlier study, in that the alternatives provided on test questions were identical to those given on study objectives; if students failed to understand test questions, it would not be because there was an ambiguous relationship between the study objectives and test questions.
In her study, Janczarek implied that the Holland and Skinner (1961) text did not make enough difference in the students' examination performance to justify the amount of time devoted to it. Thus, in the present study, the Holland and Skinner text was no longer used. This provided more time for concentrated review and remediation of the one text, by Whaley and Malott (1968).

The purpose of the present research was to determine the effect of the revised daily quiz program. In summary, the changes that were made were as follows: the use of a new procedure for remediation and review of objectives, the use of a multiple-choice format for study objectives and test questions, the use of test questions that clearly related to study objectives, and the availability of more time for review and remediation of the Whaley and Malott text. It was hypothesized that the above cited changes, incorporated in the quiz program, would further improve student performance on examinations. It was also expected that these changes would contribute to the practicality of the quiz program.
METHOD I

Subjects

In the fall semester of 1970, 275 students, out of the 2529 students enrolled in the course, volunteered to be in a special section of an introductory psychology course (Psychology 150) at Western Michigan University. They were told they would be placed in either one of two special groups, and they were given a description of the specific group requirements. The volunteers were informed that they would not be required to attend the laboratory sessions, watch the in-class video-tapes, or read the supplementary text, Walden II by Skinner (1948). Of these students, 137 were randomly assigned to an exam-only group and 138 to a quiz-plus-exam group. Before mid-term, two exam-only students and one quiz-plus-exam student dropped the course. After the mid-term exam was taken, five additional students from the exam-only group and seven additional ones from the quiz-plus-exam group dropped the course.

Once students had been assigned to one of the groups, they were not allowed to change groups or to return to the regular Psychology 150 class.
Procedure

The quiz-plus-exam students were required to attend class daily, Monday through Thursday, to take a ten-point quiz composed of ten multiple-choice questions over one chapter of the newly assigned reading material or over comparable amounts of review or remedial material. All objectives were systematically reviewed on quizzes given throughout the semester. These will be referred to as review quizzes. Objectives that more than 10% of the students failed were remediated until 90% of the students answered them correctly on daily quizzes. These will be called remedial quizzes. Every Monday and Thursday, a quiz over one chapter of new material was given; every Tuesday, a review quiz was given; and every Wednesday, a remedial quiz was given.

A record of the percentage of error on each objective was posted daily on a grid in the graduate assistants' office. Those objectives with more than 10% error were circled in red and could be readily identified. At least twenty-four hours prior to each remedial quiz, students were given supplementary hand-outs that specified the exact objectives to be remediated. Students were told the units to be covered by each review quiz, but specific objectives were not enumerated as they were with remedial quizzes.
During the daily sessions, the quiz-plus-exam students received no instructional lectures. The quizzes and the immediate, differential feedback after taking the quizzes were their only in-class instruction.

In contrast to the quiz-plus-exam students, the exam-only students were required to attend class twice during the semester, at mid-term to take a mid-term examination and at the end of the semester to take a final examination. The exam-only students differed from the quiz-plus-exam students to the extent that they did not attend class to take daily quizzes. However, both groups received identical sets of study objectives and read the same assigned text, *Elementary Principles of Behavior* by Whaley and Malott (1969).

The supplementary study objectives and term definitions were included in a book called *The Big New Mother Mind-Boggling Behavior-Expander* by Janczarek and Malott (1969). Dittoed objectives were also handed out daily to the quiz-plus-exam students. These dittoes of objectives were mailed to the exam-only students three weeks prior to each exam.

The quiz-plus-exam students took the same mid-term and final examinations as the exam-only students. Both mid-term and final exams were composed of fifty multiple-choice questions paraphrased from the instructional
objectives provided for the two groups. The mid-term examination covered the first twelve chapters of the text and the final was comprehensive over the entire twenty-three chapter text.

To reduce the chances of collusion between students taking the exams, four forms of each exam were used. On both the mid-term and final exams, forms A and B included questions which differed from the questions on forms C and D. The questions on forms A and B were identical to each other, but were arranged in different order. Likewise, the questions on forms C and D were similarly related. All forms of the exams were given during the scheduled Friday lecture periods.

Members of both groups could opt to attend a lecture offered once a week. During most of these lectures, problem objectives were discussed by the instructor. Occasionally, the lecture period was varied by the use of multi-media slide shows and guest speakers.

The course grade for the quiz-plus-exam students was determined by their performance on the daily quizzes, as well as on the two examinations. The grading scale for the daily quiz portion of their grade was as follows:

- 90 - 100 = B
- 80 - 89 = C
- 70 - 79 = D
- Below 70 = E
The grading scale for the exam portion of their grade was:

- 90 - 100 = A
- 80 - 89 = B
- 70 - 79 = C
- 60 - 69 = D
- Below 60 = E

The averaged exam scores could only raise a student's grade one letter above that received on the daily quizzes and could not lower his grade. For instance, if a student received 90% or above on the daily quizzes (equal to a "B") and 90% or above on the two exams averaged together (equal to an "A"), then his letter grade for the course would be an "A." But if he received 90% or above on the daily quizzes and any score below 90% on the exams, a student would receive a "B" in the course. On the other hand, if a student received 80% on the daily quizzes (equal to a "C") and 90% on the exams (equal to an "A"), he would receive a "B" for the course.

The course grade for the exam-only students was determined by averaging together their scores on the two exams and was arranged so that the exam-only students received the same percentage of A's, B's, C's, D's, and E's as the quiz-plus-exam students.
RESULTS AND DISCUSSION

Figure 1 is a frequency distribution of the fall mid-term examination scores. The exam-only students obtained a mean score of 80.80%, while the quiz-plus-exam students obtained a mean score of 90.16%, a difference of 9.35%. A t-test of the difference between these means yielded a value of 8.705, for 270 degrees of freedom, significant at the .001 level.

Figure 2 is a frequency distribution of the fall final examination scores. The exam-only students obtained a mean score of 76.58%, whereas the quiz-plus-exam students obtained a mean score of 91.08%, a difference of 14.50%. A t-test of the difference between these means yielded a value of 8.011, for 258 degrees of freedom, significant at the .001 level.

The results of the fall study confirm Janczarek's hypothesis that daily quizzes improve students performance on examinations.

Table 1 is a distribution of scores on the fall semester mid-term and final examinations for the quiz-plus-exam and exam-only groups. These data indicate that the revisions in the daily quiz program of
the present study added markedly to student performance on examinations, so that the quiz-plus-exam students received a much greater percentage of A's (90-100% scores) than the exam-only students. The findings clearly demonstrate the practical value of the quiz technique. If such a program is used, students are given the chance to perform nearer their maximum potential. However, in order to introduce the technique on a wide scale, a revision of existing educational practices and philosophy is needed.

To support the notion that the present study was dealing with basically similar groups, the percent mean score for the regular Psychology 150 students was computed for the fall semester. The mean scores for the regular psychology students and for the quiz-plus-exam students are included on Table 2. The means illustrate that the findings are not peculiar to the kind of students who volunteered to take part in the experiment. Rather, the results show that there is probably nothing academically special about the quiz-plus-exam students.

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1 The regular Psychology 150 students differed from the quiz-plus-exam students to the extent that they attended laboratory sessions, watched video-tapes during daily class periods, and read a supplementary text, Walden II by Skinner (1948).
Figure 1. Frequency distribution of fall mid-term examination scores for the exam-only and quiz-plus-exam groups.
PSYCHOLOGY 150
MIDTERM EXAM 1970

EXAM GROUP
MEAN % CORRECT 80.80
QUIZ GROUP
MEAN % CORRECT 90.16

% CORRECT OUT OF A POSSIBLE 50

% STUDENTS

50
45
40
35
30
25
20
15
10
5
1
6-10 12-16 18-22 24-28 30-34 36-40 42-46 48-52 54-58 60-64 66-70 72-76 78-82 84-88 90-94 96-100
Figure 2. Frequency distribution of fall final examination scores for the exam-only and quiz-plus-exam groups.
PSYCHOLOGY 150
FINAL EXAM 1970

EXAM GROUP
MEAN % CORRECT 76.58

QUIZ GROUP
MEAN % CORRECT 91.08

% STUDENTS

% CORRECT OUT OF A POSSIBLE 50

6-10 12-16 18-22 24-28 30-34 36-40 42-46 48-52 54-58 60-64 66-70 72-76 78-82 84-88 90-94 96-100
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<th>Final Exam</th>
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<td>Quiz Group</td>
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<tr>
<td>90-100</td>
<td>32%</td>
<td>76%</td>
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<td>80-89</td>
<td>31%</td>
<td>20%</td>
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<td>70-79</td>
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<tr>
<td>60-69</td>
<td>6%</td>
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<tr>
<td>Below 60</td>
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### Table 2

**MEAN EXAMINATION SCORES:**
**FALL STUDY**

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<th>Regular Group</th>
<th>Quiz Group</th>
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<tr>
<td><strong>Mid-term Exam</strong></td>
<td>90.78%</td>
<td>90.16%</td>
</tr>
<tr>
<td><strong>Final Exam</strong></td>
<td>91.20%</td>
<td>91.08%</td>
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INTRODUCTION II

The fall study was repeated during the winter semester with the following refinements: a changed grading scale for the exam-only group, rewritten study objectives, a changed format for the examinations, a revised quiz schedule, and the exclusion from the final exam of all items that 10% of the students had failed.

It was hypothesized that the incentive of the exam-only students for performing well on the exams may have been low during the fall study. Members of the group knew that, in spite of their low scores on the exams, their group would still receive the same percentage distribution of grades as those earned by the quiz-plus-exam group. To increase incentive for the later study, the exam-only students were no longer guaranteed the same percentage of A's as the quiz-plus-exam students. The exam-only students were graded on the same scale as the quiz-plus-exam students (with 90-100 an "A," 80-89 a "B," 70-79 a "C," 60-69 a "D," and below 60 an "E."), but that scale was made independent of the quiz-plus-exam students' performance.

The study objectives for the winter semester were rewritten in an attempt to clarify ambiguities observed during the fall semester. The method of distributing the
study objectives was changed. Instead of receiving objectives in daily hand-outs, each group received a complete set of study objectives at the beginning of the semester.

The examination format was changed in the winter semester. Instead of being composed of fifty questions paraphrased from the study objectives, the winter semester exams were composed of twenty questions paraphrased from the study objectives, twenty identical to the study objectives, and ten conceptual questions. The conceptual questions required understanding, interpretation, and application of material drawn from abbreviated case studies which the students had not previously seen. These changes in exam questions were made to determine whether or not the quiz technique would still be effective in improving the examination performance of the quiz-plus-exam students on questions that were unfamiliar to them.

The quiz schedule was changed in the winter semester. Instead of giving review, remedial, and new quizzes every week, review and remedial quizzes were given in blocks of approximately four every other week, alternating with about one week of quizzes over new material. This change was made to integrate the quizzes with other course activities.
Not only was the schedule changed, the objectives were reexamined for ambiguities. Only those objectives that 90% or more of the students had passed on daily quizzes were included on the final examination. This was in keeping with the underlying goal of the course to have all students obtain 90% mastery of the instructional objectives. It was felt that those objectives students were still having difficulties with by the time of the final exam should be omitted, because it was already apparent that the course goal had not been achieved with those particular objectives.

The purpose of the winter study was to determine the effect these changes in teaching methods would have on the examination performance of each group of students. As a result of the altered grading scale, it was hypothesized that the exam-only students' mean score on the exams would be increased in the winter semester. As a result of the revised quiz schedule, it was expected that the mean score of the quiz-plus-exam students would also be increased on the exams. It was expected that the rewritten study objectives, the revised examination format, and the inclusion of specific objectives on the final exam would affect the performance of both groups of students.
METHOD II

Subjects

The fall study was repeated in the winter semester of 1971 when 291 students, out of the 1143 students enrolled in the course, volunteered to be in a special section of Psychology 150 at Western Michigan University. Of the 291 students, 157 were randomly assigned to an exam-only group and 134 to a quiz-plus-exam group. Before mid-term, ten exam-only and six quiz-plus-exam students dropped the course. After the mid-term was taken, thirteen additional exam-only students and six additional quiz-plus-exam students dropped the course.

The same procedure was followed as in the fall study in assigning students to the two groups. Again, the students were not permitted to change groups or to return to the regular class once they had been assigned to an experimental group.
**Procedure**

Requirements of the two groups were the same as those in the earlier study, and the same text was used. However, the students used a revised edition of *The Big New Mother Mind-Boggling Behavior-Expander* (Malott, et al., 1970).

The educational design of the winter study differed from the fall design in the following ways: the quiz schedule was revised, the study objectives were rewritten, the method of distributing the study objectives was changed, the examination format was changed, the exam-only group's grading scale was altered, and the final exam was composed of specific objectives.

As in the fall study, the quiz-plus-exam students took the same mid-term and final examinations as the exam-only students. However, the mid-term covered the first eleven chapters (instead of first twelve) of the text and the final exam was comprehensive over the entire text. Four forms of each exam were again used to lesson the opportunity for student collusion during the exam periods.

During the winter study, students were quizzed over a total of 289 objectives. Of these 289 objectives, 20 were omitted, leaving 269 objectives. By the time of the final exam, students had reached 90% mastery on 227
of the 269 objectives that appeared on daily quizzes. Of the 227 mastered objectives, 80 appeared on the four forms of the final examination.

Again, the course grade for the quiz-plus-exam students was determined by combining the daily quiz grade and the averaged exam scores. However, the exam-only students were not guaranteed the same percentage of A's that the quiz-plus-exam students received, as they had been in the fall study. Instead, the exam-only group's grade was taken as an average of the two exam scores and was computed in terms of absolute performance, with 90-100 an "A," 80-89 a "B," 70-79 a "C," 60-69 a "D," and below 60 an "E."
RESULTS AND DISCUSSION II

Figure 3 is a frequency distribution of the winter mid-term examination scores. The exam-only students achieved a mean score of 77.334%, while the quiz-plus-exam students achieved a mean score of 87.906%, a difference of 10.572%. A t-test yielded a value of 4.875, significant at the .001 level for 273 degrees of freedom.

Figure 4 is a frequency distribution of the winter final examination scores. The exam-only students obtained a mean score of 81.120%, and the quiz-plus-exam students obtained a mean score of 86.656%, a difference of 5.536%. A t-test yielded a value of 3.484, for 254 degrees of freedom, significant at the .001 level.

The results of the winter study again indicate that daily quizzes improve student performance on examinations.

Table 3 is a distribution of scores. As in the fall study, the quiz-plus-exam students received a much greater percentage of A's than the exam-only students.

The mean scores of the regular Psychology 150 group and the quiz-plus-exam group are included on Table 4. Similar to the fall findings, the data support the notion that there is probably nothing academically special about the quiz-plus-exam students.
A detailed analysis of the three types of examination questions is provided on Table 5. As was expected, both groups of students scored lower on the paraphrased objectives than on the identical objectives, and both groups scored lowest on the conceptual questions. The results indicate that the further the format of the examination questions deviates from the original study objective format, the smaller the difference between the examination performance of the two groups.
Figure 3. Frequency distribution of winter mid-term examination scores for the exam-only and quiz-plus-exam groups.
PSYCHOLOGY 150
MIDTERM EXAM 1971

Exam Group
Mean % Correct: 77.334

Quiz Group
Mean % Correct: 87.906

% Correct out of a possible 50
Figure 4. Frequency distribution of winter final examination scores for the exam-only and quiz-plus-exam groups.
PSYCHOLOGY 150
FINAL EXAM 1971

EXAM GROUP
MEAN % CORRECT 81.120

QUIZ GROUP
MEAN % CORRECT 86.656

% STUDENTS

% CORRECT OUT OF A POSSIBLE 50

6-10 12-16 18-22 24-28 30-34 36-40 42-46 48-52 54-58 60-64 66-70 72-76 78-82 84-88 90-94 96-100
TABLE 3

DISTRIBUTION OF EXAMINATION SCORES: WINTER STUDY

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<td>Exam Group</td>
<td>Quiz Group</td>
</tr>
<tr>
<td>90-100</td>
<td>44%</td>
<td>60%</td>
</tr>
<tr>
<td>80-89</td>
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<tr>
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<td>13%</td>
<td>11%</td>
</tr>
<tr>
<td>60-69</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>Below 60</td>
<td>17%</td>
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TABLE 4

MEAN EXAMINATION SCORES:
WINTER STUDY

Mean Scores

<table>
<thead>
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<th></th>
<th>Regular Group</th>
<th>Quiz Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid-term Exam</td>
<td>89.044%</td>
<td>87.906%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>88.706%</td>
<td>86.656%</td>
</tr>
</tbody>
</table>

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**TABLE 5**

**ANALYSIS OF EXAMINATION SCORES:**
**WINTER STUDY**

<table>
<thead>
<tr>
<th></th>
<th>Exam Group</th>
<th>Quiz Group</th>
<th>Difference Between Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mid-term</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identical Objectives</td>
<td>77.851</td>
<td>90.518</td>
<td>12.667</td>
</tr>
<tr>
<td>Paraphrased Objectives</td>
<td>76.141</td>
<td>86.166</td>
<td>10.025</td>
</tr>
<tr>
<td>Conceptual Questions</td>
<td>78.360</td>
<td>86.130</td>
<td>7.770</td>
</tr>
<tr>
<td><strong>Final</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identical Objectives</td>
<td>82.425</td>
<td>90.355</td>
<td>7.930</td>
</tr>
<tr>
<td>Paraphrased Objectives</td>
<td>82.389</td>
<td>89.301</td>
<td>6.912</td>
</tr>
<tr>
<td>Conceptual Questions</td>
<td>75.810</td>
<td>77.690</td>
<td>1.880</td>
</tr>
</tbody>
</table>
DISCUSSION

The findings presented here demonstrate that the administration of daily quizzes over new, remedial, and review objectives produced practically, as well as statistically, significant differences between two groups of psychology students. The results were practical because students in the quiz-plus-exam group received approximately 30% more A's than students in the exam-only group. In spite of the fact that the exam-only students' whole grade for the course was determined by the two exam scores, whereas the quiz-plus-exam students' grade was only partially affected by examination performance, the exam students did not do as well as the quiz students on the exams.

Several factors may be operating that cause daily quizzes to improve students' academic performance on examinations, indicating a higher mastery and greater retention of materials learned. As Witters and Kent (1970) reported, short study units control the students' progress through the course. The daily quizzes used in the present study helped break down the assigned material into short study units. With the quiz program, students cannot accumulate large amounts of material to study the last day prior to the exam. Instead, they are encouraged
to study small amounts each day in preparation for daily quizzes. This helps reduce the aversive nature of lengthy exams. With the quiz technique and the reduced procrastination and improved study habits it encourages, students are better able to handle the material (Michael, 1971).

Another feature of the quiz technique is that students receive immediate feedback regarding the accuracy of their answers to quiz questions. Students are always aware of where they stand in the course and what is required of them, a factor which helps solve the student motivation problem facing many educators.

The analysis Michael (1971) has given is appropriate here. With the quiz technique, a powerful reinforcer -- the course grade -- is used more effectively to control study behavior than in the traditional educational setting. Because the grade is directly and clearly related to performance on daily quizzes, students are more apt to be motivated to work for their grade. They know that increased participation will improve their grade, because they know exactly what objectives they should study each day. In the traditional classroom, they cannot be sure that increased participation will improve their grade because the material to be covered is not always clearly specified. Furthermore, to the student in
the conventional course, mid-term and final exams are so far in the future that they exert little, if any, control over daily study behavior.

The remedial and review quizzes are also especially relevant to the quiz students' high level of examination mastery. Difficult objectives are repeated until at least 90% of the students pass them. Objectives are cumulatively reviewed to improve mastery on exams. Once a daily quiz is given, the objectives are not put aside to accommodate new material. Rather, old material and problem areas are weighted equally with new material.

The remedial and review technique, along with the rewritten study objectives and test questions, were two contrasts between the earlier study reported by Janczarek and the present study. As hypothesized, the present study showed a greater improvement in examination performance by the quiz group. In the fall, there was an average improvement of 11.93% on the combined mid-term and final exams; in the winter, there was an improvement of 8.054%. These improvements can be compared with Janczarek's improvement of 4.6% on the combined mid-term and final exams. It is felt that these improvements were directly related to the rewritten study objectives and test questions and to the revised quiz program, with the concentrated review and remediation not present in the Janczarek study.
CONCLUSION

This study has shown that a practically and statistically significant difference in mean scores on mid-term and final examinations can be obtained through the use of a daily quiz procedure with extensive review and remediation of assigned material. The quiz schedule was assumed to influence the pattern of study behavior and the amount of preparation made prior to exams. These factors, in turn, were assumed to influence examination performance.
REFERENCES


APPENDIX

A special section of high-risk students was included in the winter study. A total of 30 such students volunteered to participate in the experiment. Of the 30 high-risk volunteers, 10 were randomly assigned to a quiz-plus-exam group and 20 to an exam-only group. After the mid-term examination was taken, one quiz-plus-exam student and eight exam-only students dropped the course.

The remaining 21 students took part in the experiment just as the rest of the Psychology 150 volunteers. The course requirements were the same for the high-risk students as they were for the regular students.
RESULTS AND DISCUSSION

Figure 5 is a frequency distribution of the mid-term examination scores for the high-risk students. The exam-only students obtained a mean score of 36.20%, while the quiz-plus-exam students obtained a mean score of 62.40%, a difference of 26.20%.

Figure 6 is a frequency distribution of the final examination scores for the high-risk students. The exam-only students obtained a mean score of 54.84%, whereas the quiz-plus-exam students obtained a mean score of 64.67%, a difference of 9.83%.

The fact that the exam-only students obtained a higher mean score on the final exam than on the mid-term may be attributed to the eight exam-only drop-outs; they were students who had received the lowest eight scores (all below 30%) on the mid-term exam. With their scores eliminated, the mean score of the exam-only group was made higher. Even though eight failing exam-only students, as compared to one failing quiz-plus-exam student, dropped the course, there is still a big difference between the two groups' performance on the final exam.

The data presented here show that the high-risk students who participated in the daily-quiz program scored markedly higher on the examinations than the exam-
only group of high-risk students. From the quiz-plus-exam group, 75% of the students passed the final exam, whereas only 45% of the exam-only students passed the final exam. Not only did the quiz-plus-exam students receive a greater percentage of higher scores on the exams than the exam-only students, they also received a smaller percentage of low scores.

These results have considerable implications for educating high-risk students. The quiz program most probably controlled the quiz-plus-exam students' pattern of study behavior. It is not unreasonable to assume that, upon entering college, high-risk students have a poorly developed study repertoire. The quiz program was arranged so that the students were required to study small amounts of material each day in preparation for the daily quizzes. Students in the quiz-plus-exam group could not wait until the last day prior to the exam and then "cram" all the material at once.

Another factor that probably influenced the quiz-plus-exam students' examination performance was the program of review and remediation, which helped the students maintain a high level of mastery of the material.

Another feature of the quiz program which could have benefited the high-risk participants was the immediate feedback regarding the correct answers to quiz
questions. The quiz-plus-exam students knew just what was expected of them on the daily quizzes and were always informed of where they stood in the course.

The fact that the course grade was directly related to the quiz-plus-exam students' performance on daily quizzes could also have affected that group's study behavior. The students in the quiz group knew that the more effort they put forth, the higher their grade would be, because they knew exactly which objectives to study each day.
Figure 5. Frequency distribution of mid-term examination scores for high-risk students.
Exam Group
mean 36.20

Quiz Group
mean 62.40

% CORRECT ON MID-TERM EXAM ('71)
Figure 6. Frequency distribution of final examination scores for high-risk students.
REFERENCE