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Effects of Candy and Public Recording upon Objective Quiz Scores in a Social Studies Class

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EFFECTS OF CANDY AND PUBLIC RECORDING UPON OBJECTIVE QUIZ SCORES IN A SOCIAL STUDIES CLASS

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INTRODUCTION

"What is learned is what is reinforced."
(Skinner, 1961)

Present day American teachers attempt to use long range goals to elicit academically oriented behavior from their students. Traditionally, good grades, promotions, Phi Beta Kappa, diplomas and degrees have been held in esteem by parents and educators as a prelude to economic success. Whether in fact these status symbols lead to economic success is questionable. The attainment of these goals can be achieved only after a considerable length of time and even then every student cannot achieve them all. Actually most of the reinforcers available to schools and colleges today are used as punishments in the form of a threat of failure or dismissal. It is no wonder then that so many students fail to become motivated to pursue an education. Since most states try to enforce compulsory attendence in public schools it seems obvious that students, who do not find grades, promotions, etc. reinforcing, will tend to be unresponsive, unruly or drop out.

With the advent of the trend away from corporal punishment as a means of classroom discipline, educators have been faced with a startling fact. Entertaining or fun

classrooms are not the answer to a student's educational needs. While this may solve the disciplinary problem it does not provide for the acquisition of knowledge which is still the basic aim of education. If teachers use positive reinforcement instead of punishment it will allow them to recapture the orderly conduct once attributed to discipline (Skinner, 1961).

The Problem

There is a need for educational research to find adequate reinforcers to supplement the traditional goals of the classroom. Many studies have been conducted with this goal in mind. Unfortunately most of these studies have been with three major classifications of students: (1) the mentally retarded (2) the emotionally disturbed and (3) "normal students" in laboratory settings.

The purpose of this study was to investigate the reactions of a seventh grade social studies class to public recording and candy when presented in conjunction with the standard classroom reinforcer of grades. It was hoped that this investigation would provide evidence that methods in the field of operant behavior are effective in standard classrooms and not just "special" classrooms.

Background and Relevant Research

Behavior modification as a classroom practice has been in effect, inadvertently at least, for some time. In 1925

a study by Hurlock found that verbal praise was more effective than reproof and that reproof was more effective than ignoring a student's positive behaviors.

Nolen, Kunzelmann and Haring (1967) used the principles of behavior modification (which they termed contingency management) in Junior High classrooms at the University of Washington Experimental Education Unit.

Ullman and Krasner (1965) have found that a teacher of a classroom in which behavioral techniques are to be applied needs to follow three basic principles to achieve results:

1. The behavior which is to be changed must be clearly defined.

2. A determination must be made of what environmental functions support this behavior.

3. The environment must be manipulated in such a way that a change is elicited.

In a study conducted by Staats, Finley, Nimke and Wolf (1964) it was found that operant conditioning apparently can be readily used for the study of significant complex human behaviors--specifically school subjects such as reading.

Traditionally in the classroom situation teachers depend principally upon one type of reinforcement--the grade. It has been found however that grades are not equal in reinforcement value to all students (Brackbill & Jack, 1958).

Another factor of great importance to the behavior modifier is the promptness with which a reinforcer follows

performance and increases the impact of that particular reinforcement (Bijou & Baer, 1961; Skinner, 1956).

Skinner (1956) also observed that the schedule of reinforcement could be a significant factor in determining the strength of a reinforcer. "Reinforcing a man with fifty dollars at one time may not be so effective as reinforcing him with five dollars at ten different times during the same period[p. 101]."

The goal of classroom behavior modifiers is probably the attainment of results similar to those found in a study by Ferster and DeMyer in 1961. They concluded that as the high rate of responding to successively more difficult material actualized the establishment of a large repertoire of skills, "being correct" gained strength as a reinforcer.

In 1967 Hewett, using behavior modification techniques, was successful in affecting a positive change in the behavior of emotionally disturbed children in a public school setting.

The strength of adult verbal approval as a reinforcer was studied by Grace (1948), and Zimmerman and Zimmerman (1962). It was found that while different children respond differentially to various kinds of verbal reinforcement, teacher attention did reinforce appropriate classroom behaviors.

In a further study, Harris, Wolf, and Baer (1967) found that adult attention must be or become positively reinforcing

to a child before it can be successfully used to help him achieve more desirably effective behaviors. It was also found that for some children adult attention may be a negative reinforcer.

The strength of social reinforcers within a classroom has been investigated by Patterson and Anderson (1964). It was found that with increased age the child is increasingly responsive to social reinforcers delivered by the peer group. This was supported by Bijou and Baer (1961) who maintained that the main factor of social reinforcement among teen-agers was the esteem of their peers.

Yet another reinforcement method popular with behaviorists is token reinforcement. In this method the subject is "paid" for his responses with points, tokens or other media which in turn are "spendable" for items of the subject's choice. Haring and Hauck (1969) and Staats, Staats, Schutz and Wolf (1962) had particularly good results in accelerating correct reading responses. Study habits at school and at home were strengthened with the introduction of a token economy reward situation (Birnbrauer, Wolf, Kidder & Tague, 1965).

Food and its strength as a reinforcer was first recognized by Pavlov in his famous conditioned reflex experiments (Babkin, 1949). Kelleher and Gollub (1962) report that while food is referred to as a "primary or unconditional reinforcer" it has acquired its reinforcing effects in a

large part through conditioning.

The general reinforcing strength of food naturally led to the study of candy as a reinforcer. Terrell and Kennedy (1957) conducted a study that made comparisons of reinforcement strength between the following factors: candy, praise, token, reproof, and control. Candy was found to be strongest of all for eight- and nine-year-olds with token reinforcement close behind.

Levin and Simmons (1962) compared peanuts with teacher praise and reported that the peanuts were an effective reinforcer resulting in responses for a significantly longer time with more responses elicited than those elicited by praise.

> Comparisons of subjects who received peanuts alone with those receiving both peanuts and praise suggested that praise suppressed response rate. The results directly contradicted explanations of the boy's previous behaviors based upon attention span and frustration tolerance. In contrast, a simple explanation of the boy's behavior based upon reinforcement theory was consistent with the data [p. 545].

Candy has been effectively used by experimenters to control or modify bizarre classroom behaviors. Hewett (1964) was able to reinforce the communication skills of reading and writing in a mute autistic child. Prior to the experiment the child could neither read nor write. Disruptive classroom behavior of students was modified by Quay (1966) using reinforcement for attending behavior. In studies by Bijou and Sturges (1959) and Hopkins (1968)

a conclusion was made that candy serves as a suitable reinforcer for operant behaviors of most children.

Hypotheses

1. The null hypothesis of no significant difference was postulated for the following Test-Control comparisons: (a) Test baseline vs. Control baseline (b) Test public recording phase vs. Control second phase (c) Test candy reinforcement phase vs. Control third phase.

2. The null hypothesis of no significant difference was postulated for the following Test phase comparisons: (a) Test baseline vs. Test public recording phase (b) Test baseline vs. Test candy reinforcement phase (c) Test public recording phase vs. Test candy reinforcement phase.

3. The null hypothesis of no significant difference was postulated for the following Control phase comparisons: (a) Control baseline vs. Control Phase 2 (b) Control baseline vs. Control phase 3 (c) Control phase 2 vs. Control phase 3.

Terms Used in the Study

T = Test group

C = Control group

T_1 & C_1 = First or baseline phase

T_2 & C_2 = Second or public recording phase

T_3 & C_3 = Third or candy reinforcing phase

METHOD

Subjects

Two seventh grade social studies classes were selected by IBM scheduling as per school policy. The two groups, numbering 26 and 30 respectively tended to be homogeneously grouped as a result of this method. One group was designated as "Test" and the other "Control".

The Test group consisted of 30 members (15 boys and 15 girls). Their mean IQ was 106.70 with a range from 80 to 135. Their grade point mean was 2.10 with a range from 1.00 to 3.57.

The Control group, numbering 26 (13 boys and 13 girls), had a mean IQ of 107.34 with a range from 76 to 131. Their mean grade point was 2.34 with a range from 1.28 to 3.14.

Procedures

Both groups were taught by the same teacher using identical methods and materials. A typical 50 minute period could be described as follows:

1. The first ten minutes were devoted to a quiz covering the material to be stressed in that day's discussion.

2. The next five minutes were to collect and score the quizes.

3. A thirty minute discussion of the day's lesson then ensued. The entire class was treated as a single group.

4. The remaining time (approximately 15 minutes) was devoted to the reading of the next day's lesson. Seat work was routinely assigned one class day out of every seven when, due to scheduling, the class period was extended to 90 minutes.

The daily quizes were given to both groups. The results of the quizes were computed as percent of correct responses. Although the results were recorded each group was told that they were merely study guides and in no way would influence their grades.

The experiment was conducted in three phases. Phase one and three were approximately five weeks in length with phase two lasting two weeks.

Phase One

Baseline percentages were established for both groups but neither set of scores was disclosed to the students. At the end of this phase the mean scores for both groups were examined for differences. The Test group was selected on its slightly lower means on phase 1, IQ, and GPA.

Phase Two

The results of the first 16 quizes were disclosed to the Test group only. Every child in this group was given a personal graph upon which his scores were plotted. This was

done, they were told, to enable them to see how well they had done in relation to their classmates. Again they were assured that the quiz scores had absolutely no bearing on any grade they might receive in class.

Phase Three

The individual charts were left up but horizontal lines indicating the medians of the first two phases were drawn for each child's scores. They were told that every time they achieved a quiz score above their medians they would receive a piece of candy. The candy used was an English Toffee individually wrapped. Anyone achieving 100% was given a special treat of a large sucker.

At no time during any of the three phases were the Control group scores revealed.

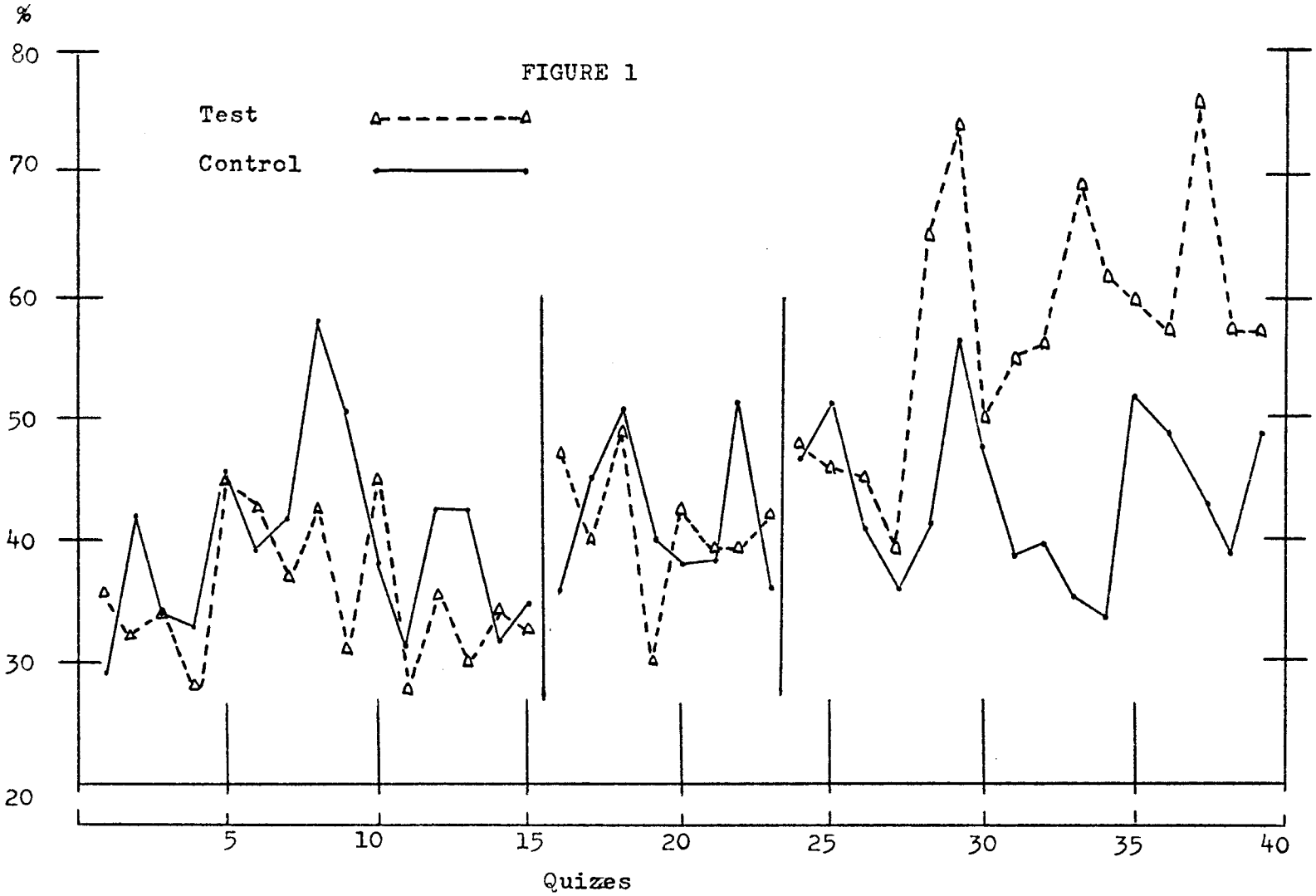
RESULTS

The Test group phases all show significant changes in their means. This would indicate that both public rate recording and candy are positive reinforcers for a seventh grade social studies class (see Figure 1). If gross amount of change is taken into account candy is a stronger reinforcer than public recording.

The Control group also made upward changes in their means from phase one to three. Of these changes, however, only a comparison of phase one and phase three produced a change magnitude of statistical significance.

The null hypothesis of no significant difference between groups T_1 and C_1 was not rejected. The Control group obtained a mean of 3.938 and a standard deviation of 1.018 while the Test group mean and standard deviation were 3.554 and 0.956 respectively. A comparison of these scores (see Table 1) revealed a nonsignificant difference at the .05 level of confidence (t=1.444).

The null hypothesis for comparisons of groups T_2 and C_2 was also not rejected. The Control group scored 4.188 and 0.935 on mean and standard deviation. The Test group scored 4.114 and 1.242 on mean and standard deviation. A t test comparison resulted in .252, not significant at the .05



QUIZ SCORE MEANS FOR TEST AND CONTROL GROUPS

TABLE 1

t TEST RESULTS

	Control			Test		
	1	2	3	1	2	3
$\bar{X}$	3.938	4.188	4.364	3.554	4.114	5.792
SD	1.018	0.935	1.018	0.956	1.242	1.375

Group Comparisons		t
C_1 vs. T_1		1.444
C_2 vs. T_2		0.252
C_3 vs. T_3	df=54	4.451**
T_1 vs. T_2		3.204*
T_1 vs. T_3		12.279**
T_2 vs. T_3	df=29	7.788**
C_1 vs. C_2		1.859
C_1 vs. C_3		2.966*
C_2 vs. C_3	df=25	1.559

*p=<.01.
**p=<.001.

level of confidence.

In the final Control-Test comparison the null hypothesis was rejected. The Control group's mean and standard deviation were 4.364 and 1.018 respectively while the Test group scored 5.792 and 1.375. A comparison of these scores revealed a significant difference at the .001 level of confidence.

A comparison of all the Test group phases (T_1 with T_2, T_2 with T_3, T_1 with T_3) resulted in the rejection of the null hypothesis for each one. A comparison of T_1 with T_2 resulted in a significant difference at the .01 level of confidence ($t=3.204$). T_2 vs. T_3 was found to be significant to .001 level of confidence ($t=7.788$). The final phase comparison for the Test group (T_1 with T_3) resulted in a significant difference at the .001 level of confidence ($t=12.279$).

The Control group phases were compared and the results are as follows. The null hypotheses for group comparisons C_1 with C_2 and C_2 with C_3 were not rejected ($t=1.859$ and 1.559). The null hypothesis of no significant difference for groups C_1 with C_3 however was rejected. A t test resulted in 2.966 which was a significant difference at the .01 level of confidence.

DISCUSSION

The mean scores for the Control group made a low steady gain throughout the entire study. As noted in the results, the mean differences between phases one and two, and two and three were not significant. However the total change in the Control mean (phase one to phase three) was significant. This can hardly be a reflection of known reinforcement since the results of the quizes for this group were never divulged. The causes for this improvement can only be conjecture. Perhaps the mere act of taking a quiz every day became an important part of the routine and therefore acted as a reinforcer. Or continued practice at taking the quizes could have resulted in improved study habits and reading skills.

The strength of these two reinforcers is apparent on the graph depicting the entire study (see Figure 1). The Test group means are above the Control means only twice in the entire first phase. The second phase shows them to be above the Control means at least half the time. In the final phase the Test means are higher 15 out of 16 times. Therefore it is concluded that the candy-public recording reinforcers are greater than the reinforcers that caused the Control group means to improve.

Some classroom implications are quite clear. Motivation

of students to learn is probably one of the greatest tasks facing teachers today. The idea of finding a universal classroom reinforcer is giving way to the concept of individually selected reinforcers. In this study not all students reacted towards the two selected reinforcers in the same way. For some both were strongly reinforcing while for others only one was effective. For a few neither was reinforcing. There is a need for further research in this area.

This study indicated that candy was a strong reinforcer for most students in the Test group. It could probably be used again in a classroom and achieve similar results. If research were to indicate a stronger classroom reinforcer, candy could be paired with the new reinforcer with even higher achievement resulting.

Candy and public recording as reinforcers have their limitations. Candy's effectiveness is probably decreased by its use after lunch or perhaps a painfully clear remembrance of the last appointment with the dentist. And as was mentioned before not all children want or like candy badly enough to work for it. Public recording, since it did not elicit as great a response as candy, has even greater limitations. In some cases it was found that public displaying of a student's scores affected a change in his behavior negatively. His scores went down. Perhaps an answer to this dilemma would be to make the posting of scores optional or privately known only to the individual concerned.

It can be surmised that the two reinforcers examined in this study would be effective in similar situations. It would be questionable to assume that they would be equally reinforcing for another age group.

The results generally agree with the studies already mentioned in the review of the literature. The only major differences were (1) the age of the subjects and (2) the emotional stability (or lack of it) as compared to a "normal" classroom.

Further research would be of value especially in the area of reinforcers and individual differences. Do certain types of students respond to certain reinforcers? Is there a relationship between IQ and reaction to reinforcement? Are sex factors important? Does achievement (GPA) correlate to reinforcer reactions? These are but a few of the questions that should be answered by future research.

SUMMARY

The effects of candy and public recording as reinforcers to a seventh grade social studies class were studied. Since traditional classroom reinforcers were believed to be inadequate, the study was conducted to establish the effectiveness of other reinforcers. Two classes were selected and designated "Test" and "Control".

Both groups were given daily quizes on material covered in class. The Test group was reinforced for correct responses while the Control group's results were never divulged. The Test group's mean quiz scores gained significantly more than the Control group's, an indication of the strength of the reinforcers.

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APPENDIX

APPENDIX

RAW SCORES

TEST GROUP: PHASE ONE

S	Correct Responses per Quiz (10 possible)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
TB			4	3	7	6	6	6	7	5	5	6	3	9	6
BC					3	3	5	5	6	6	2	6	5	5	4
LC	5	3	4	2	9	8	6	8	6	7	4	3	6	7	
JC									2	4	1	3		1	2
DE							1	4	4	5	3	5	4	4	3
CE					5		5	6	0	3	7	1	2	2	3
LG								2	3	6	1	6	3	3	4
VH				2	2	7	2	6		2				3	3
DH	1	6	4		3		3	2	2	1	1	2	3	1	1
EJ	6	4	1	1	4	4	3	5	0	3	0	3	2	0	4
LL	1		4	4				3	1	6					
JL	5	0	4	3	2	3	1			2	2	4	4	2	2
ML				·			4	2	3	6	4	4	0	2	3
LL	2	4	6	8	1	5	3	2	4	4	4		2	4	
JM	3	4			3	3	1	2	2	5	1	4	1		
PM	3	3	3	3	4	4	1	6	1	6	1	2	4	5	5

BM	2	3	5	5	2	4	2	4	1	2	2	2	4	4	1
MM	5	3	2	3	4	3		2	3	3	4	4	4	2	1
DM	5	4	6	4	7	6	7	7	8	8	3			6	3
AO					5			3	3	6	3	3	3	2	3
KP			4	3	6	7	6	5	2	8	6	6	5	4	4
DP	3	1	2	4	5	3	4		4	6	4	5	3	4	4
GQ	4	5	3	2	6	5	4	4	5	3		2	1	3	2
TR		3	4	3		4	2	5		5	4	7		4	6
SR	3	3	2	2	4	4	3	6	3	2	1	4	1	2	4
KS	3	2	4	2	6		4	4	4	3	4	2	4	5	5
RS	5	4	3	1	2	7	3	6	4	4	2	3	4	4	2
DT				1	1	3	2	3	2	6	4	1	1	3	3
MW	4	4	1		3	5	6	5	4		1	3	4	0	4
SZ	4	4	1	4	6	2	5	4	2	6	4	3	4	4	4

RAW SCORES

TEST GROUP: PHASE TWO

S	Correct Responses per Quiz (10 possible)							
	16	17	18	19	20	21	22	23
TB	8		4	3	6	6		2
BC	5	7	8	4	6	4	8	8
LC	9	5	10	7	5	7	6	7
JC	2	3	4	2	3	4	2	4
DE	4	1	7	2	5	2	4	2
CE	7	4	1	3		1	4	2
LG	6	4	6	3	2	5	5	5
VH	6	8	5			2	5	8
DH	2	4	6	0	1	2	2	3
EJ	3	0	9	3	3	2	4	4
LL	4	2	7	5	3	5	6	4
JL		2	3	2		4	4	5
ML	3	3		3	2	4	4	3
LL	9	5	3	2	5	3	1	4
JM		2		1	3	5	3	1
PM	6	8	10	5	6	3	4	6
BM		3	4	3	5	4	1	3

MM	4	3	4	4			5	1
DM	4	7	4	2	9	5	6	4
AO	4	2	3	1	2	2	2	7
KP		7	6	5	8	6	8	9
DP	5	3	7		5	4	6	8
GQ	5		5		7	3	1	3
TR	4		3	2	3	4	6	3
SR	4	4	5	5	7	6	1	4
KS	7	6	5	1	3	5	2	5
RS	4	5	5	4	4	5	4	8
BT	4	2	0	3	1	2	3	3
MW		4	5	4	2	5	3	5
SZ	2	3	3	2	4	2	4	1

RAW SCORES

TEST GROUP: PHASE THREE

S	Correct Responses per Quiz (10 possible)															
	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
TB	7	9	5	5	8	8	9	5	7	8	9	9		10	8	10
BC	6	5		1	4	8		3	7	8	5	8			4	4
LC	6	7	8	7	9	9	8	5	7	7	7	10	7	9	8	9
JC	3	3	3	1	1	2	4	2	2	3	3	4	4	4	5	3
DE	4	6	4	2	3	7	6	4	7	9	4	5	7	6	6	4
CE	2	2	5	6	5	8	7	2	5	7		8	3	9	9	1
LG	7		4	5	6	8	1	6	5	8	5	4	5	9	7	6
VH	5	6	7		10	10	7	5	8	9	10	7		8	6	
DH		2	4	2	8	8	9	8	2	8	7	10	6	10	8	3
EJ	5	6	3	2	5	5	2	5	6	6	5	6	7	7	1	1
LL	6	6	5		7	8	7	8	5		4		5	9	9	7
JL	5	4	5	3	1	7	4	5	1	5	4		5	1	5	3
ML	4		4	5	3	4	1	4	4	2	6	5	2	4	6	3
LL	5	8	6	9	8	10	7	7	7	9	9	8	8	9	8	10
JM	2	7	4	2	6	8	6	3	2	5		8				10
PM	5	4	5	4	5	9	7	7	6	6		4	3	8	5	5
BM	4	4	6	2	3	5	2	5	6	2		2	3	7	1	3

MM	5	4	4	4	8	7	3	9	4	3	1	3	3	6	4	4
DM	5		8	5	10	8	8	9	9	8	7	8	8	7	5	10
AO	2	2	2	3	4	7	4	3	7	5	7		4	8	4	5
KP	7	3	5	5	10	9	8	8	7	8		8	7	8	5	
DP	5	6	2	8	10	8	6	7	6	9	9	7	6	10	8	8
GQ	4	4	4	6	9	8	5	6	7	8	1	3	5	7	4	7
TR	6	4	5	5	10	7	3	6	6	7		5	8	9	6	7
SR	5	5	5	6	8	7	7	5	6	9	8	4	3	9	7	8
KS	5	4	6	4	5	9	2	6	8	10	8	5	8	8	9	4
RS	6	4	5	2	10	10	3	7	8	9	9	7	10	10	7	
DT	4			2		6	1	3	2	7	5	4	10	5	2	4
MW	4	4	2	2	6	6	4	7	6	6		3	5	7	6	6
SZ	5	1	1	1	8	8		6	6	6	10	10	8	7	8	3	9

RAW SCORES

CONTROL GROUP: PHASE ONE

S	Correct Responses per Quiz (10 possible)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
JB		6	4	3	6		7	7	5	7	5	7	9	3	6
MC	5	4	1	4	5	3	3	6	5	6	3	3	5	4	2
DC	3	6	1	2	3	2			5	5	1	4	2	3	4
AC	1	3	3	5	4	7	5	6		5	4	3	4	1	3
BD	6	4	6	5	7	3	4	9	3	3	3	6	4	4	1
MD										0	2	3		3	3
TD	2	4	6	3	6	4	2	4	5	2	2	5	3	2	5
RF	1	5	3	4	4	3	3	5	8	3	2	3	3		3
LH	5	8	8	6	8	6	9	9	6	6	6	6	7	6	5
RH	2	2	3	2	5	5	3	3	4	2	3	5	7	3	4
CH	1		2	2	4	5	2	6	5	5	3	6	2		5
SH	3	5	3	3	4	1	3	5	5	3	1	5	4	4	5
TJ										5	3	6	6	5	4
MK	1	0	6	6	6	5	2	7		3	4	2	6	2	2
BL	3	3	4	4	7	4	7	9	7			5	6	4	2
DM	4		5	2	4		6	5	5	3	2	5	5	3	4
AM	4	4	3		2	3	1	3	5	4	1	2	2	0	

SM	4	4	4	5	7	3	5	6	5	2	5	3	2	2	0
DP	2	2	0	2	4	3	2	5	3	7	2	5	3	4	4
TP	5	5	4	5	3		3	5	5	2	5	3		3	4
KS	2	5	3	2	3	5	4	5	6	4	5	2	4	3	5
VS	3	2	2	1	1	3	2	3	5	2	2	3	4	2	2
LS	4	5	5	3	3	5	9	7	6	4	5			4	6
BT		7	2	2		4	7		5	4	5	7	4	9	
DT										4	4	5	3	3	3
RZ	0		1	2			3	7	5	5	0	4	5	2	2

RAW SCORES

CONTROL GROUP: PHASE TWO

S	Correct Responses per Quiz (10 possible)							
	16	17	18	19	20	21	22	23
JB	5	7	8	5	4	6	8	4
MC	3	6	4	1	4	3	3	5
DC	6	3	4	1	5	3	3	6
AC	4	6	9	8	6	4	4	2
BD	4	5	5	5	6	3	5	1
MD	2	4	3	5	5	2	3	1
TD		3	0	3	2	5	6	2
RF	4	3	4	8	3	2	7	5
LH	7	4	7	5	7	6	7	3
RH	3	4	6		3	3	5	7
CH	4	5	3	1	2	2	2	4
SH	3	7	3	4	5	5	5	6
TJ	5	4	5	5	3	5	4	4
MK	3	5	8	4	6	2	5	3
BL			4	3	4	7	6	5
DM		6	6	3	2	4	8	5
AM	1	2		5	2		6	1

SM	3	5	4	2	0	5	6	3
DP	3	5	6	4	3	0	1	6
TP			1	4	4		4	
KS	4	4	5	3	3	3	7	3
VS	3	2	6	4	0	1	3	2
LS	5	4	6	7	4		5	3
BT	3	6	7	3	7	6	8	6
DT	3	4	6	1	6	5	7	2
RZ	1	4	7	4	4	4	6	

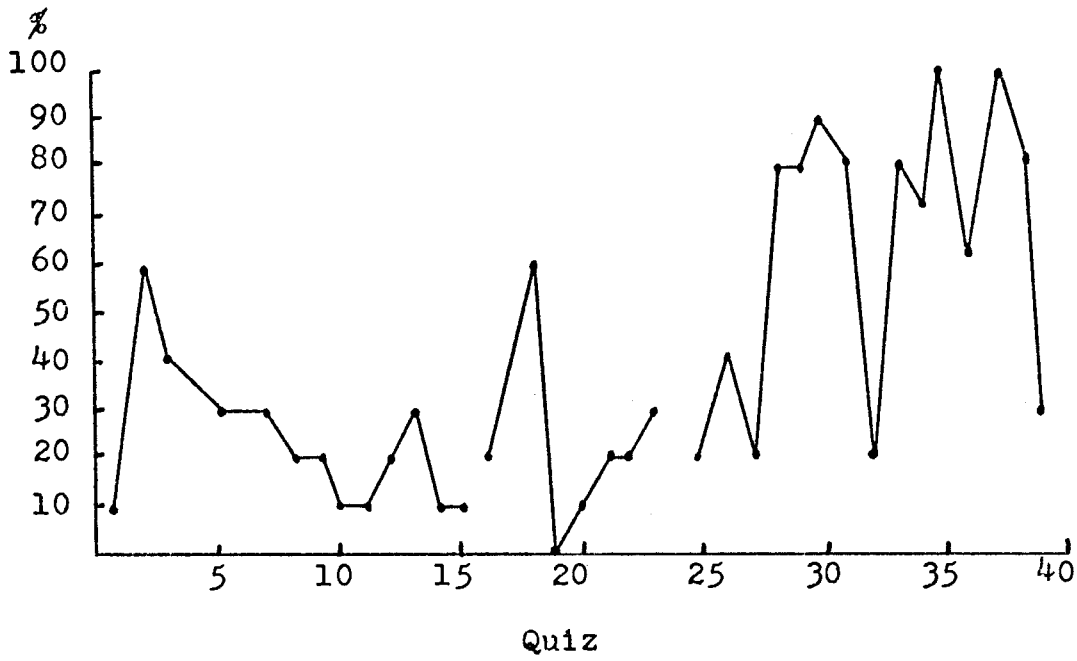
RAW SCORES

CONTROL GROUP: PHASE THREE

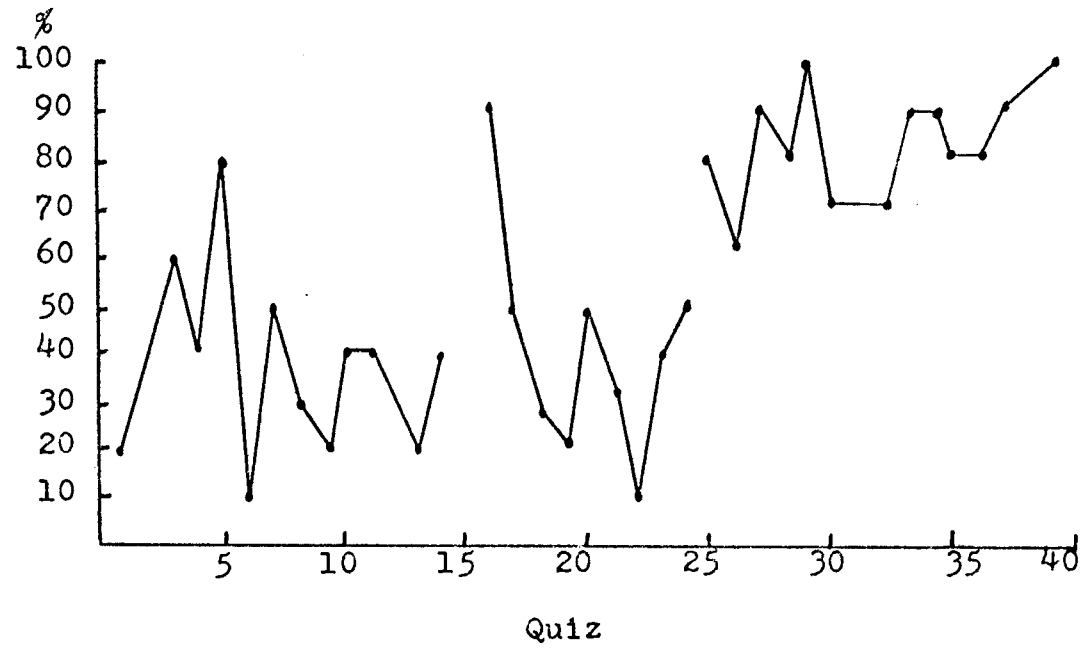
S	Correct Responses per Quiz (10 possible)															
	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
JB	4	7	6	4	3	6	8	5	5	6	2	7	7	6	3	7
MC	4	4	5	3	4			3	4	4	1	7	6	6	3	6
DC	6	7	3	4	6	5	4	4	3	4	2	5	3	5	5	7
AC			3	3	7	4	4	4	4	6	1	7	4	2	5	6
BD		9	3	4	8	6	9	6	6	4	4	8	4	7	2	4
MD	5	1	1	1	5	3	5	3	2	2	6	3	4	3	3	4
TD	4	5	4	4	4	6	4	5	3	2	4	4	4		2	4
RF	5	3	7	3	6	7	4	2	3	3	3	6	5	6	4	7
LH	5	9	8	6	4	7	9	6	9	4	3	7	5	5	5	7
RH	5	4	7	5	3	4		4	3	3	4	6	4	4	3	3
CH	3	2	2	2	2	6	3	4	1	2	2	1	4	2		
SH	8	8	5	3	4	5	6	3	5	4	6	8	4	2	7	3
TJ	3	5	5	4	4	5	3	5	4	7	3	5	3	3	2	4
MK	6	5	1	4	5	6	4	3	6	3	1	5	6	4	6	5
BL	5	6	6	4	6	8	6	7	4	7	3	6	7	5	8	8
DM	6	6	4	3	5	7		5	8	2	5	3	7	7	7	3
AM	3	2		1	3	4		1	0	0	8	3	5	2		

SM	1	1	3	4	2	7	2	2	4	1	6	5	5	5	3	2
DP	3	5	6	2	2	6	2	2	3		4	6	5	1		3
TP	2	4	3	5	3	6	5	4	1	0	2	4	5	6	3	
KS	5	5	3	4	2	5	3	4	4	4	2	3	4	5	2	1
VS	2	4	3	4	3	6	3	3	5						2	
LS	9	8	2	5	3	4	6	5	4	5	4	4	4	6	3	7
BT	5	9	6	4	4	7	7	3	6		6	6	6	10		9
DT	9	6	3	3				6	4	4	1	7	7	2	4	7
RZ		4	5	4	5	6	5	3	3	5	3	5	5	3	3	0

TWO SAMPLES OF INDIVIDUAL GRAPHS USED BY TEST GROUP*



Subject: D. H.



Subject: L. L.

*Reduced $\frac{1}{2}$.