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ABSTRACT

This paper presents a model for studying the effects of operant conditioning on reading behavior. Four academically deficient college sophomores, two of whom were reinforced for appropriate responses, were chosen as subjects. After surveying each of 25 chapters comprised of 636 appropriate topic sentences, all four subjects were given mimeographed tests that measured the subjects' ability to discern and mark the appropriate material. The subjects' performance showed that reinforcement of surveying behavior following a lecture on the subject was more effective than a lecture without reinforcement. Reinforced subjects made significantly fewer surveying omissions and performed better on tests. [Not available in hard copy due to marginal legibility of original document.] (Author/RC)

CENTRAL VIRGINIA COMMUNITY COLLEGE

Lynchburg, Virginia

Office of Director of Institutional Research

Operant Conditioning of College Study Behavior

Research Report No. 5-70

Director of Institutional Research

M. Douglas Reed, Ph.D.

ABSTRACT

Operant Conditioning of College Study Behavior

Operant conditioning procedures were utilized to assure the successful surveying study behavior of four academically deficient college sophomores.

They were asked to watch and listen to a video-taped lecture on surveying: the reading aloud, in order, of all bold-faced headings and the first sentence under each heading throughout the assigned work increments. Typical college textbook material was used for greater relevance. The students were diagnosed by pre-experimental records and observation, as academically deficient and void of survey study behavior. The experiment was conducted in a room specially designed for video taping and recording the subjects' behavior. Trained student experimenters supervised the experiment from an adjacent room where the subjects' performance was observed by TV monitor and heard by earphones.

The subjects sat at a desk which had on it a study light which they could see and a large clock, the face of which they could not see. On the clock face was a small light which was not visible to the subjects. The subjects and the study light (synchronized with the clock and its light) were videotaped (from the room in which the experimenters were stationed) through an opening in the wall.

Two of the subjects (one male and one female) were randomly assigned to be reinforced and the other two were not reinforced. Reinforcement consisted of the study light coming on (under the control

of the experimenters) when appropriate topic sentences were vocalized properly. The light remained on until inappropriate topic sentences were read (additions) or appropriate ones were skipped (omissions). When either occurred the study light was turned off until appropriate text material was read. Most of the time the light remained on, since appropriate behavior most often was emitted. The clock light was synchronized with the study light.

Non-reinforced subjects did not know when their behavior was appropriate, since reinforcement (the study light) was withheld. Whenever they emitted appropriate behavior, however, the clock light was turned on for purposes of analysis.

The experimenters tallied the numbers of surveying or acquisition omissions and additions by means of noting the time on the clock face when the light was on or off. Surveying time was tallied also.

After surveying each of the 25 chapters comprised of 636 appropriate topic sentences, the subjects were given mimeographed tests. These contained true statements incorporating all the topic sentences in that increment as well as others incorporating distracters, or inappropriate topic sentences. The tests measured the subjects' ability to discern and mark the appropriate material.

Performances showed that as designed, the reinforced subjects were under stimulus control of the study light. Reinforcement of surveying behavior following a lecture on the subject was more effective than a lecture without reinforcement. That is to say that the reinforced subjects, as hypothesized, made significantly fewer surveying omissions

and performed better on the tests.

Student experimenters were demonstrated as capable supervisors of the experiment. Video-taping proved to be a highly reliable objective means of maintaining continuous records.

FOCUS OF THE STUDY

It has become increasingly well established that operant techniques are effective in conditioning human behavior and that various changes in behavior including study behavior have been effected by utilizing different reinforcers and reinforcement schedules (Goldiamond, 1966; Fox, 1966). However, one of the major problems in teaching good study habits is procrastination. Students do not begin the study process, no matter how good that process might be when begun. For this reason alone, initially inspiring lectures on how to study are ineffective.

The experiment outlined in this article was based on the premise that a lecture on surveying behavior with modeling, followed by operant conditioning of that behavior, is more effective than the lecture and modeling with no reinforcement. If this is true, then successful acquisition of survey behavior, by students diagnosed as void of survey behavior, is basically a problem of stimulus control and reinforcement. A review of the literature revealed that many of the problems in conditioning human verbal responses (Holz and Azrin, 1966; Staats 1962; Spielberger and others, 1962), were probably militated against by the design of this experiment.

The three specific aims of the experiment were as follows:

1. To investigate the efficacy of reinforcement following a lecture versus a lecture only.
2. To devise a procedure for surveying college textbook material in such a way that surveying could be brought

under stimulus control.

3. To accomplish the experiment at minimal professional expense while allowing for intensive study of the subjects involved.

It must be recognized that the tests used in the experiment were measuring recall ability, not depth of comprehension. Obviously, it would not be desirable to build a study system based primarily upon recall or short range retention and this was not the intent of this experiment.

METHOD

The subjects in the experiment were four sophomore students at Central Virginia Community College, Lynchburg, Virginia: two female and two male. All four subjects had low grade point averages. The subjects graduated from the same local high school. Their American College Test (ACT) composite scores were 3%, 11%, 16% and 34%. Interestingly, the subject with the 34% had the lowest grade point average. Before the experiment began, the four subjects were asked if they would like to participate in an experiment in reading and study development. They were selected after screening of possible subjects to avoid experimental attrition since that would have been harmful to the experiment as designed. After extensive interviews, it was found that these four had the time, felt the experiment would accomplish some valuable part of that objective and they enthusiastically agreed to participate.

Before the experiment, the subjects were asked to study a chapter in the book in preparation for testing on that chapter. They studied in the experimental room for thirty minutes, during which time

they were videotaped. They were told to study as they normally would. An analysis of their study behavior revealed that they opened the book to the appropriate chapter and, without regard to the length of the work unit or time, started at the beginning and read until time was called.

There were three experimenters utilized in the experiment. One was the principal investigator; the other two were undergraduate students, one female sophomore and one male freshman. The two students were trained to employ the same procedures as the principal investigator.

The experiment was conducted in a specially designed room at Central Virginia Community College. An office was converted by removing one wall and replacing it with an opaque screen through which videotaping was done. The room was as free from distractions as possible. The subjects sat at a study desk. On the desk was a clock, the face of which was only visible to the TV camera. The desk also held a study lamp which turned on to reinforce the two subjects who were to be reinforced and turned off for the entire session for those who were not to be reinforced. A light on the clock was synchronized with the study light and it was used to indicate appropriate behavior during the sessions.

A divider screen separated the experimental room from another room where the technical apparatus was located. In the separate room were the TV camera, the TV monitor and facilities for the Experimenter to supervise the sessions. Although there are examples in the literature of experimental designs incorporating audio-visual apparatus (Bijon and Baer, 1966: Flanagan and others, 1958; Rheingold and others, 1965), the apparatus and design used in the present experiment seem innovative and useful for possible replication.

For the experiment, two books were used: Study-Reading College Textbooks (Christ, 1967) and Introduction to Psychology (Hilgard and Atkinson, 1967). Additionally, twenty-five mimeographed tests with varying numbers of questions were utilized. The text selections chosen were similar to those used in typical freshman or sophomore courses. Within the material chosen as the required work increments were a total of 636 phrases or sentences referred to as topic sentences. Each chapter contained varying numbers of topic sentences which were designated as the appropriate ones to be read during the experiment. The test questions covering each work increment were designed to measure the retention of the ideas contained in the topic sentences. They were biased so that omissions or additions in reading would cause poorer scores.

The subjects independently surveyed at one sitting in the experimental room the fifteen chapters from Study-Reading College Textbooks. After surveying each chapter, a short test was taken to measure the effectiveness of the surveying behavior. In subsequent sessions, each subject was required to survey the first ten chapters from Introduction to Psychology. After surveying each chapter, he left the room to pursue his normal routine. Twenty-four hours later he returned to the experimental room to take a test measuring the effectiveness of the previous day's surveying behavior. The test complete, the subject would survey the next chapter.

The following two experimental surveying conditions served as the independent variables: (1) In this condition the two subjects chosen at random to be reinforced received reinforcement (i.e., the study light was turned on and remained on) when proper behavior was emitted;

(2) In this condition the two subjects chosen to receive no reinforcement did not receive reinforcement (i.e., the study light remained off) although they were emitting desired survey behavior.

The following two factors served as the dependent variables: (1) errors of omission during acquisition trials, namely, not reading correct topic sentences; and (2) test responses on the twenty-five tests taken. Reading inappropriate topic sentences was at first considered to be a relevant dependent variable as was surveying time, but were later viewed as irrelevant since the primary aim of surveying and studying is to read all appropriate material and do well when tested on that material.

EXPERIMENTAL DESIGN

The experiment was designed as follows, to follow the operant conditioning model:

1. Identify the terminal behavior. A chained performance emitting survey behaviors was established as the terminal behavior. The subject matter was the topic sentences in the twenty-five chapters from the two books. The requirement was that the student must read aloud systematically all bold-faced headings and the first sentences in the reading assignments.

2. Measure of terminal behavior. By videotaping the subject through the screen's opening into the experimental study room, the experimenters were able to observe the TV monitor and hear by the earphones the survey of the work increments. Continual observation was recorded by videotape.

In the case of the reinforced subjects, when the appropriate

surveying behavior was emitted, the study light on the desk was turned on by the experimenter from a remote switch. The study light was synchronized with the light on the clock; therefore, when the study light came on, the light on the clock came on also. The videotape recorded both lights.

Under nonreinforced conditions, the study light did not come on when appropriate survey behavior was emitted, but the light on the clock did. This prevented the subjects from knowing when their behavior was appropriate, yet allowing accurate recording of behavior.

3. Determine operant level. The current operant level of each subject was determined by observing performances emitted in the experimental study room before treatment started. He was observed by monitored videotape for one hour. The analysis of pre-treatment behaviors of the student disclosed the number and intensity of incompatible or non-helpful activities, such as underlining and copious note-taking. Surveying behavior was tabulated with notations of frequency and duration. The analysis showed that the subjects emitted no behavior that was similar to the survey behavior considered appropriate.

Before beginning the surveying of each of the work increments, some modeling was accomplished. The principal investigator gave a lecture on surveying which was videotaped in the experimental room at the study desk. After giving a basic lecture discussing the topic sentences which should be read aloud, and in what order, the principal investigator modeled surveying behavior by actually surveying a chapter in a textbook. After this modeling, the principal investigator told the subjects that they would be tested over the material they were to read during the

experiment and that it was important to do it right since it would help their score. Then he summarized what content constituted appropriate topic sentences to be read aloud. The subjects were instructed on the taped lecture what not to read as well as what to read. Another summary followed as the approximately 12-minute lecture was terminated.

Independently, each of the four subjects was required to view the lecture by the principal investigator. The book that was used for modeling was opened for them to the appropriate page and they were instructed, on the tape, to turn the pages and read silently, as the principal investigator read aloud, the appropriate topic sentences. After the lecture had been viewed, the investigator queried each concerning the tape. They were asked to state in their own words what they were to do in order to do proper surveying. Without exception, they stated precisely which topic sentences were appropriate and what constituted appropriate topic sentences; that is, they knew how to survey properly.

4. Structure a favorable situation. The study room was set up as previously described with as few distractions as possible.

5. Stimuli for appropriate behavior. These chained performances constituted the operant:

	OCCASION	PERFORMANCE	REINFORCER
a.	Presence in the study room at appropriate time.	Sitting at desk with book open to appropriate place.	Sight of first page of work increment.
b.	Book open to appropriate place: sight of first page of work increment.	(1) Turning pages of work increment, as required. (2) Saying aloud the words that constitute the bold-type sub-headings. (3) Reading aloud the first sentence following the sub-heading title.	Sight of headings. Desk light coming on (signifying that reinforcement is being applied).

6. Remove opportunity for incompatible behavior. This was accomplished to a great extent since there were few distractions in the study room. When incompatible behavior was emitted, the study light did not come on or, if already on, was turned off. The major incompatible behavior that occurred was an attempt to read inappropriate topic sentences or omit appropriate ones.

7. Establish motivation. The study light which came on when appropriate behavior was emitted was the reinforcer. It was also a reinforcement when it remained on, indicating performance of appropriate surveying. Turning the light off indicated that positive reinforcement was not possible.

8. Shape the desired behavior - one condition only. The subjects at first were reinforced for coming to the experimental study

room, sitting at the study desk and having the text material open before them. During the first phase of the survey, i.e., reading aloud the first bold-faced type, the light came on signifying reinforcement. As the desired behavior continued, the light remained on.

9. Utilize stimulus control. At first it was thought that the reinforced subjects should take less time to survey the required work increments than would the non-reinforced subjects. After the first session, however, it became readily apparent that it was virtually impossible for the first group to take less time to survey. On the contrary, it would almost inevitably require more time. When the reinforced subjects omitted a topic sentence the light went off. They stopped reading momentarily, went back to the last known appropriate topic sentence and tried again -- all of which required time. Since errors of both omissions and additions cost the reinforced subjects time, they almost inevitably took longer to survey a work unit than did the non-reinforced subjects.

10. Keep continuous records. Videotape recordings were kept throughout the entire experiment. The clock on the study desk was utilized to determine the times that were important; namely, beginning and ending times. The audio portion of the videotape recordings were analyzed to determine acquisition errors, both omissions and additions.

The mimeographed tests covering the twenty-five work increments were retained as they were completed by the subjects. They were scored by the experimenters to determine the number of correct and incorrect responses marked.

RESULTS

The results of the experiment are presented in two sections. Section one is a comparison of error percentages of acquisition omissions under two learning conditions during surveying. The second section is a comparison of test score percentages under two learning conditions after surveying. Table 5 presents a summary of the four statistical comparisons for both of the dependent variables, totaling sixteen analyses.

The experimental design chosen to investigate these data was the single-factor analysis of variance using repeated measures (Winer, 1962). The extensive design compared each of the two subjects learning with reinforcement with each of the two subjects learning without reinforcement.

ACQUISITION OMISSIONS

Acquisition omissions have been defined in the broader sense as acquisition errors, but more specifically as omissions of appropriate topic sentences during surveying. In each chapter surveyed there were different numbers of appropriate topic sentences. Omissions were any failures to vocalize such topic sentences in the proper sequence. Every occurrence of an omission from its proper sequence was tallied. Reinforced subjects might have omitted a sentence, returned to the appropriate sentence before the omission, then omitted again the same sentence previously omitted. In such a case two omissions would be tallied, yet only one topic sentence was omitted.

The number of omissions was divided by the total number of appropriate topic sentences in that chapter, producing a percentage which was used for statistical comparison (see Tables 1 and 2).

TABLE 1

GROUP AVERAGE PERCENTAGE AND INDIVIDUAL PERCENTAGE
OF ACQUISITION OMISSIONS UNDER TWO LEARNING CONDITIONS
OVER THE 15 CHAPTERS IN SESSION ONE

Chapters (1-8)

	1	2	3	4	5	6	7	8
Condition R	M=41.66	M=28.571	M= 0.	M=25.00	M= 0.	M=16.666	M= 0.	M= 0.
	S1=33.333 S2=50.000	S1=14.285 S2=42.857	S1= 0. S2= 0.	S1= 0. S2=50.000	S1= 0. S2= 0.	S1= 0. S2=33.333	S1= 0. S2= 0.	S1= 0. S2= 0.
Condition NR	M=41.666	M=35.714	M=25.000	M=10.000	M=14.285	M=33.333	M= 9.090	M=12.500
	S1=50.000 S2=33.333	S1=35.714 S2=35.714	S1=25.000 S2=25.000	S1=10.000 S2=10.000	S1=14.285 S2=14.285	S1=16.666 S2=50.000	S1= 9.090 S2= 9.090	S1=12.500 S2=12.500

Chapters (9-15)

	9	10	11	12	13	14	15
Condition R	M=12.500	M= 0.	M=25.000	M=49.999	M=15.625	M= 5.000	M= 0.
	S1= 0. S2=25.000	S1= 0. S2= 0.	S1= 0. S2=50.000	S1=81.818 S2=18.181	S1=12.500 S2=18.750	S1= 0. S2=10.000	S1= 0. S2= 0.
Condition NR	M=25.000	M=16.666	M=16.666	M=45.454	M=40.625	M=20.000	M=20.000
	S1=25.000 S2=25.000	S1=16.666 S2=16.666	S1=16.666 S2=16.666	S1=45.454 S2=45.454	S1=56.250 S2=25.000	S1=20.000 S2=20.000	S1=30.000 S2=10.000

TABLE 2

GROUP AVERAGE PERCENTAGE AND INDIVIDUAL PERCENTAGE
OF ACQUISITION OMISSIONS UNDER TWO LEARNING CONDITIONS
OVER THE 10 CHAPTERS IN SESSIONS 2-11

Sessions

	2	3	4	5	6
Condition R	M= 0.	M= 1.190	M= 2.272	M= 1.086	M= 0.
	S1= 0. S2= 0.	S1= 0. S2= 2.380	S1= 0. S2= 4.545	S1= 0. S2= 2.173	S1= 0. S2= 0.
Condition NR	M=12.068	M=17.856	M=15.908	M=28.260	M=18.103
	S1= 5.172 S2=18.965	S1=14.285 S2=21.428	S1=11.363 S2=20.454	S1=23.913 S2=32.608	S1=17.241 S2=18.965

Sessions

	7	8	9	10	11
Condition R	M= 0.	M= 1.063	M= 0.	M= 0.	M= 2.272
	S1= 0. S2= 0.	S1= 2.127 S2= 0.	S1= 0. S2= 0.	S1= 0. S2= 0.	S1= 0. S2= 4.545
Condition NR	M=19.444	M=19.148	M=17.499	M=10.124	M=14.772
	S1=16.666 S2=22.222	S1=14.893 S2=23.404	S1= 3.333 S2=31.666	S1= 1.851 S2=18.518	S1= 0. S2=29.545

TABLE 3

GROUP AVERAGE TEST SCORE PERCENTAGE AND INDIVIDUAL TEST SCORE PERCENTAGE
UNDER TWO LEARNING CONDITIONS
OVER THE 15 CHAPTERS IN SESSION ONE

Chapters (1-8)

	1	2	3	4	5	6	7	8
Condition R	M=79.175	M=92.000	M=95.475	M=62.824	M=66.000	M=58.000	M=71.171	M=38.892
	S1=91.675 S2=66.675	S1=84.000 S2=100.00	S1=100.00 S2=90.950	S1=83.333 S2=42.316	S1=80.000 S2=52.000	S1=58.000 S2=58.000	S1=64.029 S2=78.314	S1=35.457 S2=42.328
Condition NR	M=50.000	M=40.992	M=50.000	M=50.000	M=38.000	M=52.333	M=28.571	M=39.157
	S1=50.000 S2=50.000	S1=53.414 S2=28.571	S1=50.000 S2=50.000	S1=50.000 S2=50.000	S1=44.000 S2=32.000	S1=58.000 S2=66.666	S1=14.285 S2=42.857	S1=35.457 S2=42.857

Chapters (9-15)

	9	10	11	12	13	14	15
Condition R	M=50.000	M=74.649	M=78.999	M=30.000	M=76.000	M=72.000	M=66.000
	S1=50.000 S2=50.000	S1=66.666 S2=82.633	S1=66.666 S2=91.333	S1=16.000 S2=44.000	S1=60.000 S2=92.000	S1=52.000 S2=92.000	S1=52.000 S2=80.000
Condition NR	M=25.000	M=66.666	M=66.666	M=40.000	M=40.000	M=56.000	M=70.000
	S1=25.000 S2=25.000	S1=66.666 S2=66.666	S1=66.666 S2=66.666	S1=40.000 S2=40.000	S1=40.000 S2=40.000	S1=60.000 S2=52.000	S1=60.000 S2=80.000

TABLE 4

GROUP AVERAGE TEST SCORE PERCENTAGE AND INDIVIDUAL TEST SCORE PERCENTAGE
UNDER TWO LEARNING CONDITIONS
OVER THE 10 CHAPTERS IN SESSIONS 2-11

Sessions

	2	3	4	5	6
Condition R	M=54.977	M=44.238	M=37.041	M=66.666	M=34.545
	S1=59.864 S2=50.091	S1=46.163 S2=42.313	S1=50.933 S2=23.150	S1=58.333 S2=75.000	S1=29.091 S2=40.000
Condition NR	M=34.563	M=57.699	M= 5.562	M=48.216	M=28.181
	S1=16.809 S2=52.318	S1=79.812 S2=35.587	S1= 9.266 S2= 1.858	S1=59.525 S2=36.908	S1=40.000 S2=16.363

Sessions

	7	8	9	10	11
Condition R	M=41.545	M=25.118	M=50.589	M=28.465	M=62.155
	S1=56.160 S2=26.930	S1=38.436 S2=11.800	S1=52.056 S2=49.122	S1=16.160 S2=40.770	S1=70.000 S2=52.310
Condition NR	M=17.310	M=32.454	M=43.572	M=27.695	M=24.235
	S1= 0.000 S2=34.620	S1=64.273 S2= .636	S1=42.111 S2=45.033	S1=10.770 S2=44.620	S1=33.080 S2=15.390

TABLE 5

SUMMARY OF STATISTICAL COMPARISONS

	Comparisons (F tests)			
	A	B	C	D
	RS1 NRS	RS1 NRS2	RS2 NRS1	RS2 NRS2
I. Survey Omissions				
Session One	13.537 *	42.636 *	.960 ns	.485 ns
Sessions 2-11	18.655 *	183.582 *	20.299 *	180.663 *
II. Test Scores				
Session One	7.405 *	4.667 *	19.263 *	13.622 *
Sessions 2-11	1.532 ns	6.537 *	.377 ns	6.034 *

* Significant at the .05 level of confidence

ns = Not significantly different.

Figures 1 and 2 demonstrate the extensive design comparing the individual subjects under each of the two learning conditions. Reinforced subjects made significantly fewer acquisition omissions on two of the four comparisons in sessions one, and on all four comparisons in sessions 2-11. All appropriate topic sentences were read by both reinforced subjects, and they did it with fewer errors than did the non-reinforced subjects.

Where non-significant differences were found as in Session one: C and D, it was not because the reinforced subjects and the non-reinforced subjects made equally large omission error percentages, but that all subjects did about equally well. Of the forty-five observations in question, only three exceeded 46% error. Although these comparisons did not show significant differences, the scores reveal that the lecture apparently was equally effective for both learning conditions. It is of note that the performance of reinforced subject one was significantly better when compared to non-reinforced subjects than was that of reinforced subject two. It was not readily apparent why reinforced subject two occasionally (on three of the fifteen chapters) made several omissions, thus raising his error percentage to a level similar to that of the non-reinforced subjects. Perhaps reinforced subject two caught on more slowly than reinforced subject one, since during sessions 2-11 his performance on this criterion was significantly better than the non-reinforced subjects.

TEST SCORES

Each subject was tested over a chapter previously surveyed before surveying the next one. The tests contained varying numbers of

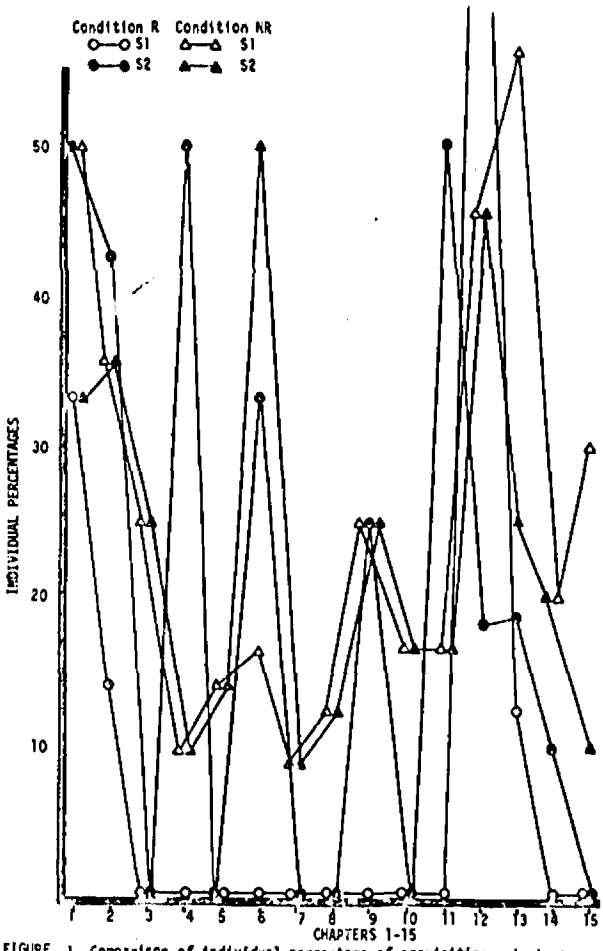

FIGURE 1. Comparison of individual percentage of acquisition omissions under two learning conditions over the 15 chapters in session one.

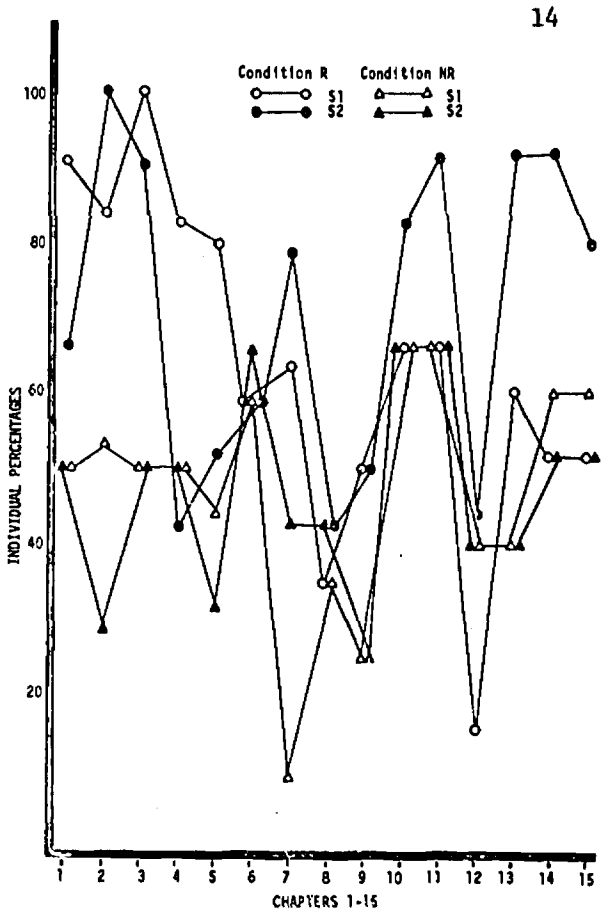

FIGURE 3. Comparison of individual test score percentage under two learning conditions, for the 15 chapters in session one.

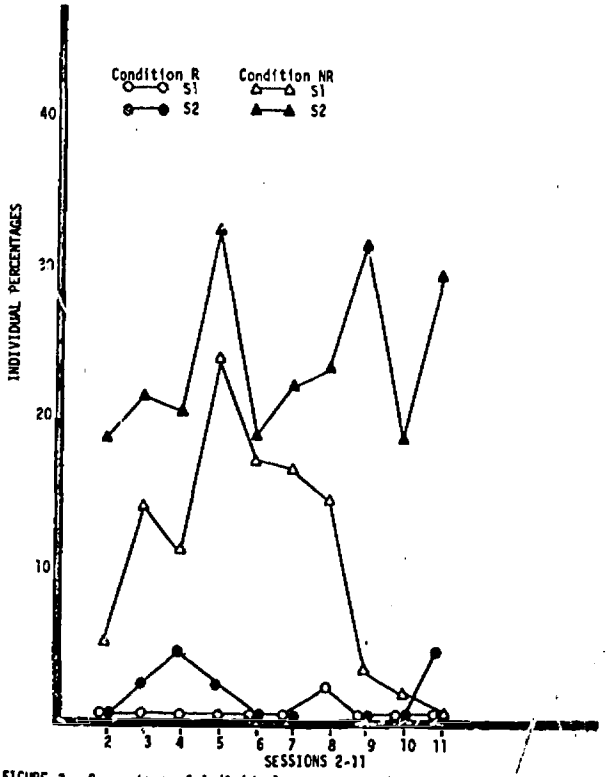

FIGURE 2. Comparison of individual percentage of acquisition omissions under two learning conditions over the 10 chapters in sessions 2-11.

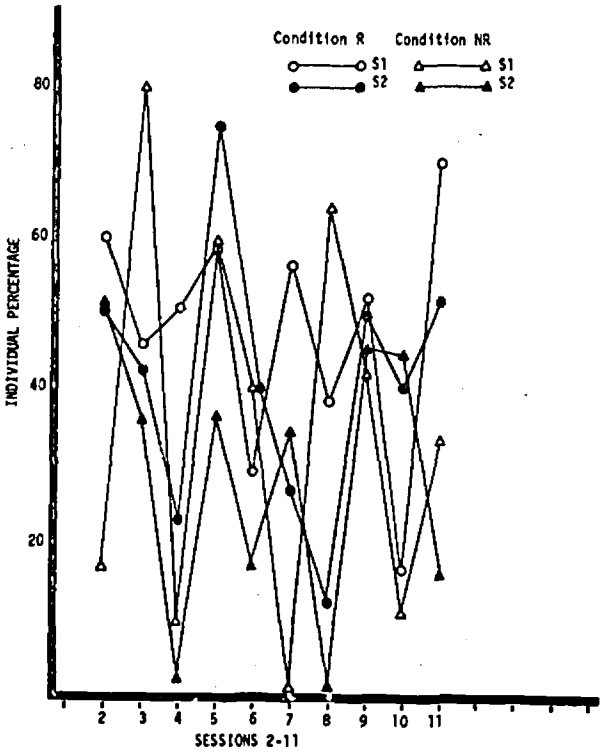

FIGURE 4. Comparison of individual test score percentages under two learning conditions over the 10 chapters in sessions 2-11.

true statements based on the chapter content. The task was to choose the statements which contained the ideas in the material they were directed to survey.

The tests were designed primarily to measure, by recall, the effect of surveying behavior. It was assumed that the subjects who properly surveyed the material would recognize the ideas, words or phrases from that material. If they made no omissions or additions they should do better on the tests than would subjects who had surveyed improperly.

On the tests there were varying numbers of keyed items and approximately two-thirds more distracters. The tests were power tests and all subjects had ample time to finish. For each of the comparisons, test score percentages were derived by dividing the number of keyed items answered by the total possible number of correct answers (see Tables 3 and 4). Figures 3 and 4 demonstrate the extensive design comparing each of the individual subjects under learning conditions reinforced and non-reinforced.

Reinforced subjects made significantly higher test scores on all four comparisons in session one, and on two of the four comparisons in sessions 2-11. Where non-significant differences were found (sessions 2-11: A and C) the reinforced subjects read as much inappropriate material as did the non-reinforced subjects and took significantly longer to do so.

It seems evident from the data gathered that tests on the more sophisticated content, taken after at least 24 hours (sessions 2-11), were more difficult for both groups, but perhaps more so for the reinforced group. It may be stated that the kind of learning to be derived

from surveying was tested rigorously by the 24-hour delay before examination took place. Surveying behavior does not require that subjects retain content for periods of time up to 24 hours. It is a study device used primarily to gain an overview of a chapter. It is a preliminary step before question formation, which leads naturally to purposeful reading. Examining the subjects after 24 hours over material they had seen for only a few seconds was asking for an unusual performance yet, amazingly, the performance of the reinforced subjects was evidence of the effect of reinforced learning.

Overall, the results of the experiment were considered successful in all three specific aims: (1) 75% of the hypotheses concerning surveying omissions and test scores were significant. It was generalized that reinforcement, following a lecture and modeling on survey behavior, is more effective than a lecture and modeling with no reinforcement; (2) it was apparent that surveying behavior was under stimulus control of the study light at the study desk; (3) the experiment was accomplished at minimal professional expense while allowing for intensive study of the subjects involved.

IMPLICATIONS

Having brought surveying behavior under stimulus control, a logical progression would be to bring the other facets of good study habits under stimulus control. It appears hopeful that this might be accomplished in a manner similar to, or more useful than, the present experiment.

The variation between subjects, though they are basically

similar in performance, indicates the need for intensive study of greater numbers of subjects and perhaps over longer periods of time. It appears that the experiment would have yielded more information and been somewhat more appropriate in design had a reversal been done. That is, if the non-reinforced subjects had been reinforced after a period of time and the performance of the reinforced subjects which previously brought reinforcement no longer was reinforced. What might have occurred can only be hypothesized.

Further, it occurred to the principal investigator that the experiment might well have been done with more students to measure more effects, such as sex differences or academic ability.

Additionally, it is possible that the presence of the Experimenter in the study room where the reinforced subjects could see him might serve as an added social reinforcement, a conditioned reinforcer. It might be feasible to have a large group of students shaping and reinforcing each other's behavior in a classroom setting.

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