

THE EFFECTS OF OPERANT CONDITIONING OF STUDY BEHAVIOR  
AMONG ACADEMICALLY DEFICIENT COLLEGE SOPHOMORES

by

M. Douglas Reed  
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Dissertation submitted to the Faculty of the Graduate School  
of the University of Maryland in partial fulfillment  
of the requirements for the degree of  
Doctor of Philosophy

1970

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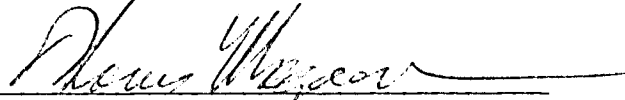
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Title of Thesis: The Effects of Operant Conditioning of Study Behavior  
Among Academically Deficient College Sophomores.

Name of Candidate: M. Douglas Reed  
Doctor of Philosophy, 1970

Thesis and Abstract Approved:



Thomas M. Magoon, Ph.D.  
Professor  
College of Education

Date Approved: 3/14/70

## ABSTRACT

Title of Thesis: The Effects of Operant Conditioning of Study Behavior  
Among Academically Deficient College Sophomores

M. Douglas Reed, Doctor of Philosophy, 1970

Thesis directed by: Thomas M. Magoon, Ph.D.

Operant conditioning procedures were utilized to assure the successful surveying study behavior of four black 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. Together with the subjects, 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. There was little difference in surveying additions since few were made under either condition. Contrary to the hypotheses the time required for surveying was usually longer for the reinforced subjects since they were under stimulus control of the light.

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

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CHAPTER I  
INTRODUCTION

It has become increasingly well established that operant techniques are effective in conditioning human behavior, and that various changes in behavior have been effected by utilizing different reinforcers and reinforcement schedules.

Analysis of study problems in particular has indicated that the techniques of operant conditioning are effective in developing good study habits (Goldiamond, 1966; Fox, 1966). Fox found that the use of Robinson's (1962) Survey, Question, Read, Recite, Review (SQ3R) "is a system of study far superior to those commonly used by students" (p. 85).

However, one of the major problems in teaching good study habits is procrastination. Students don't begin the study process, no matter how good that process might be when begun. Often, for this reason alone, initially inspiring lectures on how to study are ineffective. As Fox points out "although further analysis could probably improve on the Survey Q3R method it would be sufficient accomplishment to put this system into wide use" (p. 85).

In light of these observations it is reasonable to assume that operant conditioning may be effective in developing facility in the use of the "Survey" technique of the SQ3R. Analysis of the operant regimen may reveal that reinforcement would bring survey behaviors under stimulus control. Fox said that "previous experience tells us that it is easy to establish surveying behavior" (p.88).



A question of concern at this point is whether operant treatment of survey behavior (vocal emission of appropriate topic sentences) is more effective than a lecture on survey behaviors with no reinforcement. Another question is that of implementing effective treatment since the costs of professional supervision of an operant regimen militate against extensive use. What is needed is an inexpensive treatment requiring as few professionals as possible, while effecting desirable changes in many students.

Fox stated that his pilot study "left more to be desired" (p.89), and expressed the view that "improvements will be discovered only by more intensive and precise investigation of the behavior of a single student" (p.89). To solve the operant treatment problems, he further stated that "it will be necessary to develop means of obtaining more reliable measures of the students' adherence to schedules, actual time spent in the study room" (p.89).

This experiment, unlike his, was an attempt to demonstrate that operant conditioning of survey behavior, following a lecture on the subject, is more effective than a lecture on the subject with no reinforcement. It was assumed, based on the literature, that survey behaviors could be brought under stimulus control by reinforcement. Correspondingly, attention was centered on an intensive study of two students under each study condition with attempts to solve the limiting problems faced in Fox's pilot study. This experiment was more precise than his in that it obtained adequately reliable objective measures.

Since lack of good surveying behavior concerns stimulus control, the specific problem or task was to have the study situation assume

stimulus control over the student, in particular, by a study light, i.e., there should be a differential frequency of surveying behavior in the presence of the study light which was not evident in the absence of the light. Both Goldiamond and Fox thought that any stimulus control (e.g., a study desk) should be subject to the student, that is, the student should decide when it would assume stimulus control.

The desk used in the Goldiamond case study could be used only for reading and study, nothing else. Goldiamond did not present aversive stimuli when the subject used his desk for such purposes as daydreaming, sleeping, letterwriting, or light extracurricular reading, rather he left it up to the subject to know when he was doing this and to alter his behavior accordingly--to get away from the desk, or to desist. Fox also allowed the student to make a record of violations of the desired operant behavior. In fox's study there was also an aversive stimulus which occurred the next time the subject met with the experimenter--not until.

As Fox noted, for a rigorous operant regimen this appeared problematic. At the early stages of the operant, students do not emit the desired behaviors readily. If they violate the requirements for good study in the absence of the experimenter without an aversive stimulus, it is not revealed to the experimenter until the next treatment session. Even at that time the behaviors are only self-reported and are therefore suspect.

A further purpose of this experiment, then, was to bring under stimulus control specified desirable behaviors as well as to withhold

reinforcement for undesirable behaviors at the time emitted. Accordingly, two students were both reinforced and punished (i.e., reinforcement was withheld) immediately, while the other two students were neither reinforced nor punished.

#### Selected Review of the Literature

The last decade or so was a fruitful one for studies in operant conditioning and reinforcement techniques. The literature, though sparse before 1955, contains many studies which were done since then.

Animal studies. The majority of the studies must be described as conditioning of animals in controlled laboratory situations. An excellent example is Cantania's (1968) work containing sixty articles, over fifty per cent of which were written since 1947, and the content of which is almost entirely animal studies. Travers (1964) noted that "the nature of the bulk of the literature on reinforcement is indicated by the fact that our review has been appropriately named by our secretary 'The Rat Book'" (p. 224). Other works containing valuable bibliographies or experimental findings are Ferster and Skinner (1957), Ayllon and Azrin (1968), Walker (1967), and Smith and Moore (1966).

For the purposes of this present experiment, animal studies offer maximum derivatives in terms of operant procedures, rather than specifically relevant outcomes. It is surprising that more of the effort expended in animal studies has not been realized in studies with human learning. Kimble (1967) and Hilgard and Marquis (1961) may be the outstanding exceptions. Especially useful are their examples of constructs and operational definitions of facets of operant conditioning such as acquisition stated in terms of probability. Skinner (1968) observed that "educational psychologists have long been devotees of research, but the

pattern of a laboratory science has not been closely followed" (p. 319). He referred to a lack in their experiments of coming to grips with "the behavior of the individual student in the act of learning" (p. 319). This experiment has grappled with this problem in that it is an extensive study of individuals in the act of learning one specific chained behavior (i.e., performances linked by common stimuli) called surveying.

Reading studies. There is no lack in the literature for studies concerning reading. There are ample studies concerning studying itself. What is lacking are studies concerning operant conditioning of the study behavior of college students. There are many studies concerned with the reading development of children. Part of that literature is a group of studies concerning reinforcement techniques of children's reading development and behavior. Hauserman (1969) reviewed the literature concerning operant conditioning of children's reading, including "remedial programs and maturational vs. learning theory orientation" (pp. 3-11). It was demonstrated by her own study that operant techniques were effective in assuring "successful acquisition of an 80-word reading vocabulary for first and second graders predicted as probable reading failures" (p. 55).

Psychotherapy and programmed instruction. There is a good deal of literature related to operant treatment is psychotherapy (for example, Ban, 1964), and a greater amount having to do with the principles of programmed learning. Holland (1964) gives an excellent review of the literature on programmed learning. In that such studies often call for verbal and written responses on the part of the Ss as part of the regimen,

they would appear as valuable sources of learning, since related somewhat to the present experiment. On close examination, however, there are few valuable derivatives from those studies that are related to the present one. The major finding from such studies is that operant techniques are effective in controlling human verbal responses (Holland, 1964; Holz and Azrin, 1966). Holland (1966) points out that in his experience with teaching machines he observed that "students stop work when the material is so difficult that they make many errors. Furthermore, they become irritated, almost aggressive, when errors are made" (p. 78). These learnings were applied in the present study in that increments were designed to be small enough and easy enough to prevent such emotional factors, if possible.

Conditioning human verbal responses. Holz and Azrin (1966), reviewed the literature concerning conditioning of human verbal response, from Greenspoon's pioneering study (of the reinforcing effect of two spoken sounds on the frequency of two responses) to 1965 (p. 797). They summarized, based on the literature, the ten problem areas for any operant conditioning experiment relating to human verbal response. They appear to be concise, and their work was quite helpful in the designing of the present experiment; therefore, they have been mentioned as follows:

1. "Delimitation of the response class" (p. 797).
2. "Thematic control" (p. 799).
3. "Response units" (p. 800).
4. "Operant level" (p. 800).
5. "Duration of experimental sessions" (p. 802).

6. "Adequacy of the reinforcing stimulus" (p. 802).
7. "Consistency of the reinforcing stimulus" (p. 803).
8. "Immediacy of reinforcement" (p. 803).
9. "Influence of the observer" (p. 804).
10. "Mental causes" (p. 805).

The present experiment was designed in such a way as to overcome the problems cited above, while incorporating the desirable facets of operant conditioning of human verbal response, as discussed by Holz and Azrin (1966). The areas where innovations have produced good remedies to bothersome problems are related to their items numbered 6-9 (see below Experimental Design, p. 23).

Staats (1962) noted in keeping with 8 above that "reading learning should be studied in a procedure involving the immediate application of positive reinforcers for attending to and working at the acquisition of textual responses" (p. 844).

Spielberger and others (1962) investigated the effects of awareness and attitude towards the reinforcement on the operant conditioning of verbal behavior. They found that "only Ss who were aware of correct contingency between the reinforcement and their own responses showed significant acquisition of the conditioned-response class" (p. 120). Further, they observed that "the performance of aware Ss was specific to the pronoun or pronouns for which they were aware of a correct contingency and was strongly related to the Ss' attitudes toward the reinforcement. There was no evidence that unaware Ss learned" (p. 120). These findings were incorporated into the design of the present experiment, allowing for

reinforced Ss to know the contingency, but not the non-reinforced Ss.

Bendig (1951) used college students as Ss to investigate the selection pattern of answers to multiple choice tests. He found that "the effect of reinforcement is to increase variability", and that "the greater the number of reinforcements the greater will be the variability of response" (p. 107). Additionally, Marx and Bunch (1951), discovered that "errors made several trials previously tended to be repeated more frequently following the occurrence of even a completely new reinforced response, as a function of their closeness in stimulus presentation steps to the reinforcement" (p. 104). In light of the complexities of the awareness of correct choices, the Ss in the present study were not aware of the outcome of their responses--either right or wrong.

In various studies, Buss (1956), Curry (1960), and Meyer and Seidman (1960), employed conceptual verbal learning tasks using both adults and children as Ss. Their findings were confirmed by Spence (1964, 1966). Spence and Segner (1967), demonstrated that "under instructional conditions in which the reinforcement procedures are not explained, a verbal reinforcement combination in which correct responses are followed by 'right' produces poorer performance on a two-alternative discrimination task than a 'wrong' or 'right-wrong' combination" (p. 29).

These findings indicate that a proper understanding on the part of the Ss of reinforcement procedures is vital; therefore, this was done in the present experiment.

Studies related to motivation and aversive stimuli. In other studies, Brackbill and O'Hara (1958) found that children were less motivated to obtain material rewards than they were to escape punishment (p. 751). No tangible rewards were given to Ss in the present experiment, while an aversive stimulus was applied when in appropriate behavior was emitted.

Canon (1967), using elementary school students found that performance in terms of task completion time and errors, indicated that "prior social isolation did increase susceptibility to the disruptive effects of the social distractor but not to the impersonal distractor" (p. 589). This led him to think that "the degree to which task-irrelevant auditory stimuli will interfere with performance is in part dependent upon an interaction between the motivational state of the organism and the nature of the distractor stimulus" (p. 589).

Distracters were kept to a minimum in the present experiment, and those few were all impersonal, for example, an opening through which video-taping was done.

Another possible effect upon performance was discovered by Ferster and others (1962), who considered the patient's recognition of the results of his efforts at self-control to be the main reinforcer for their continued application. Successfully following instructions provided by the therapist or by the patient himself may also have reinforcing value.

It may be that the subjects' attempts to please the experimenters in the present experiment was a reinforcer although not designed to be.



Its conditioned reinforcement, if applicable, would certainly have done no harm to the design.

With all the effort expended (as revealed in the literature) to emphasize positive reinforcement, it was surprising to find, as did Jones (1968), the number of successful studies using aversive stimuli, especially with self-destructive patients. Although not applicable in the present experiment as used in most of these studies, a mild aversive stimulus was both warranted and used.

More useful works have appeared which explain operant techniques clearly, such as Reynolds (1968) and Barlow (1968). Although they contain no experimental findings, they are excellent reminders of procedures necessary for operant conditioning. Unfortunately, these works as some others in their prefatory remarks are somewhat overly defensive of the misunderstanding of operant techniques.

There are examples in the literature of experimental designs incorporating audio-visual apparatus such as Bijou and Baer (1966), Flanagan and others (1958), and Rheingold and others (1965). The latter refers to an experiment which utilized a control lever, a TV camera, a projector, earphones, and a window for observation. The apparatus and design used in the present experiment seem innovative and useful for possible replication.

By far the most useful source was that of Ulrich and others (1966). In addition to two quite relevant works by Goldiamond (1966) and Fox (1966), it contains many articles on human operant behavior. Some of the

limitations of the studies by Goldiamond and Fox mentioned previously should not detract from their value as operant conditioning of human behavior. Although somewhat limited in design and rigor, it must be agreed with Ulrich and others (1966) that "Fox's careful and complete analysis of the behavioral repertoire known as 'study habits' should be as welcome as a fresh spring breeze, both to the teacher who tries to advise on 'study habits' and to the student who must actually use them" (p. 74). Ulrich and others (1966) felt that the main contribution of Fox's study is "its attention to bringing the initiation of study behavior under stimulus control, since such initiation is obviously pre-requisite to study" (p. 74).

This present experiment was designed to utilize many of the findings of Fox (1966) and Goldiamond (1966), yet do a more intensive study of a few students in the act of learning specified survey behavior. It was hoped that this limited beginning facet of the more complex group of behaviors in study habits could be brought under stimulus control of a study light on a study desk.

The findings of Fox (1966) and Goldiamond (1966) seem to indicate that the goals set for the present experiment were realistic and quite feasible. As Skinner (1968) points out, enough in experiments has already been done to "justify the prediction that what is now learned by the average college student will someday be learned in half the time with half the effort" (p. 319).

### Focus of the Study

This experiment was based on the rationale that a lecture on surveying behavior, followed by operant conditioning of that behavior, is more effective than the lecture 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.

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 Ss involved.

### Definition of Terms

Since many terms were used specifically during the experiment, they should be defined clearly.

Experimental learning conditions are two:

R has been defined as the learning condition in which reinforcement (a study light) was employed;

NR has been defined as the learning condition in which no reinforcement was employed.

Surveying has been defined operationally as the S's emission of correct vocal response, namely, the 636 topic sentences, upon presentation of the work increments or chapters.

Surveying errors have been defined as either omissions of any of the 636 appropriate topic sentences or additions of any inappropriate vocal responses (called, for sake of convenience, inappropriate topic sentences).

Topic sentences have been defined as the printed words within the 25 work increments, or chapters, which constitute all the bold-faced headings and the first sentence under each of the bold-faced headings.

Acquisition trials have been defined as vocal responses by the Ss which they considered to be the reading aloud of an appropriate topic sentence.

Acquisition errors have been defined as vocal responses which do not constitute appropriate topic sentences. For tabulation purposes, they have been defined further to include omissions of appropriate topic sentences.

#### Limitations of the Study

This experiment was an attempt to bring survey behavior under stimulus control by use of an operant conditioning treatment. It was understood that the Ss' study behavior would not change drastically and that his grades would not climb dramatically. It was assumed that this experiment was only one step toward development of an extremely complicated chained performance called good study habits. It was assumed further that unless the first step--a precise one,--could be brought under stimulus control, the other facets would not be, in that they are less clearly structured.

It was realized, too, that the tests used in the experiment were measuring not great depth of comprehension, but rather recall ability. It would be undesirable, obviously, to build any study system based

primarily only upon recall or short range retention, and this was not the intent of this experiment.

## CHAPTER II

### METHOD

#### Subjects

The subjects (S) in the experiment were four sophomore students at Central Virginia Community College, Lynchburg, Virginia. All were Negroes: two female and two male. The two females had cumulative grade point averages (G.P.A.) of 1.240. One male's G.P.A. was 1.789, while the other, returning from academic suspension, had only a .63 G.P.A. All four had been on academic probation for at least one previous quarter for falling below a 1.50 level.

The Ss graduated from the same local high school. Their American College Test (ACT) composite scores were 3%, 11%, 16%, and 34%. Interestingly, the S with the 34%, the highest, had the lowest G.P.A.

Before the experiment began, the four subjects were personally asked if they would care to participate in an experiment in reading and study development. They were actually selected from a total of six who were screened by questioning in order to avoid experimental attrition, since that would have been harmful to the experiment as designed. It was explained that those who were to be selected needed to be willing to expend a great deal of effort toward improving their study behavior; and, in turn, these four were selected since (in addition to their having met all other criteria) they expressed that they felt the experiment

would accomplish some valuable part of that objective. It was found that these four did have sufficient time for the experiment. Finally, these four enthusiastically agreed to participate.

Subsequently, though still pre-experimentally, they were asked to study a chapter in the book in preparation for testing on that chapter, and they were asked to study in the experimental room for 30 minutes, during which time they were video-taped. They were told to study as they normally would. An analysis of their study behavior revealed no behavior remotely resembling the scanning or surveying procedure described below. The Ss opened the book to the appropriate chapter and, apparently without regard to the time or length of the work unit, simply started reading the first sentence, continuing through the work unit until time was called. None demonstrated surveying or scanning behavior.

Another similarity was that of financial deprivation. The Ss worked to supplement their families' income, or to provide money needed for college expenses. Thus, they had the factor of reduced study time.

#### Experimenters

There were three experimenters (Es) utilized in the experiment. One was the principal investigator; the other two were two undergraduate students: one female sophomore, and one male freshman. The two student Es were trained to employ the same procedures as the principal investigator. The principal investigator supervised primarily, while the two student Es carried out the experimental sessions. Occasionally, for smoother scheduling of sessions the principal investigator ran an experimental session.

The two student Es each averaged about 50% of the sessions. There was a planned but unsystematic schedule of sessions, and both Es supervised both reinforced and non-reinforced Ss.

The Es were tested for consistency of performance, and the interjudgment reliability was very high. This was accomplished partly by a technique of marking the appropriate topic sentences to be read, and partly by extensive practice with them by the principal investigator. The knowledge obtained from a pilot study helped the Es predict where and what type of problems would occur. These situations were practiced so that the Es performed consistently in the same manner.

The two student Es were employed by the college for the experiment as part of a student help program. In addition, they were enrolled in a seminar-type course for credit. Part of the task for that course was to become familiar with behavior principles and operant conditioning. Their mastery of certain basic principles of operant conditioning made them an asset not only in the technical manipulation of the Ss in the experimental room, but in the overall success of the sessions, especially in questionable situations in the absence of the principal investigator.

#### Apparatus and Physical Environment

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 video-taping was done. Figure 1 is a pictorial description of the experimental room.

The experimental room, designed by the principal investigator, was free from as many distracters as possible. The Ss entered the room by a



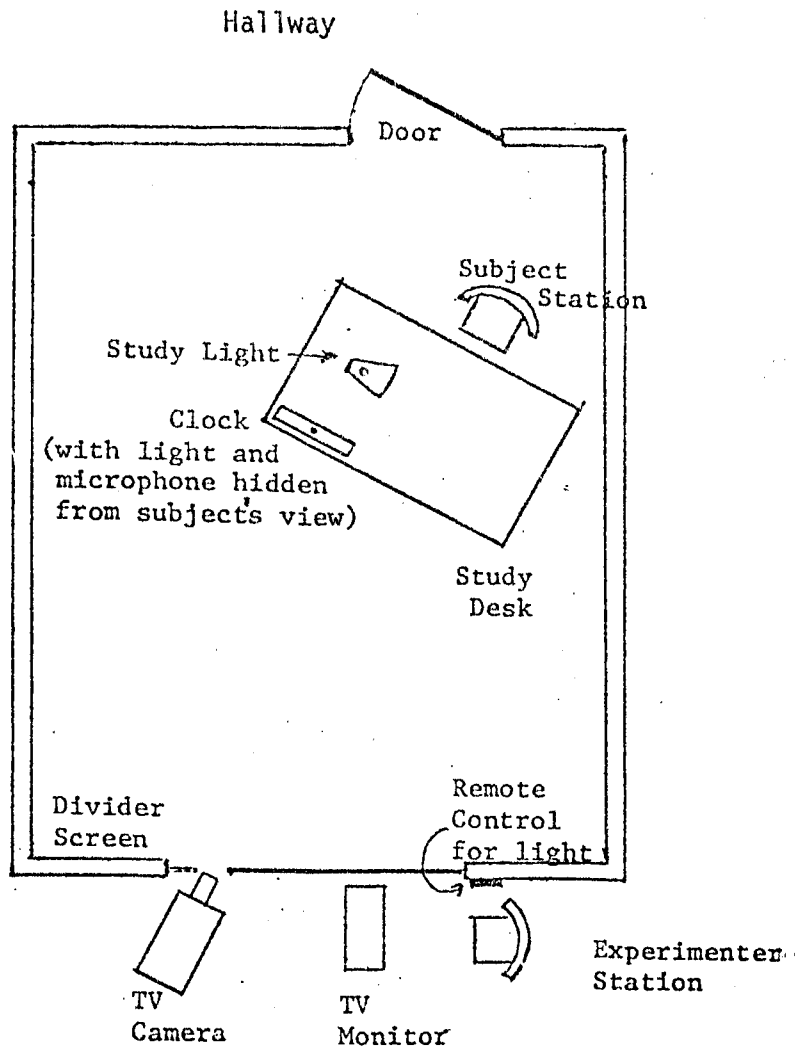


FIGURE 1. Diagram of the Experimental Room.

door from a typical hallway in one of the instructional buildings at the college, and during the sessions the Ss sat at a study desk. On the desk was a clock, the face of which was only visible to the TV camera. Also, on the desk was a study lamp which turned on to reinforce the two Ss 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. Being in a small box attached to the clock directly above the dial face, the light also was visible only to the TV camera, not to the Ss. Figure 2 is a representation of this setting.

A divider screen separated the experimental room from another room where the technical apparatus was located. Located in this separate room were the TV camera, which recorded the sessions; the TV monitor, used by the Es to view the session proceedings in the experimental room; and a station, including a chair, earphones, and a remote switch for the lights on the clock and on the desk, where the Es sat to supervise the sessions.

For the experiment, two books were used: Study-Reading College Textbooks (Christ, 1967) and Introduction to Psychology (Hilgard, 1967). Additionally, 25 mimeographed tests with varying numbers of questions were utilized.

The text selections chosen for the experiment 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.

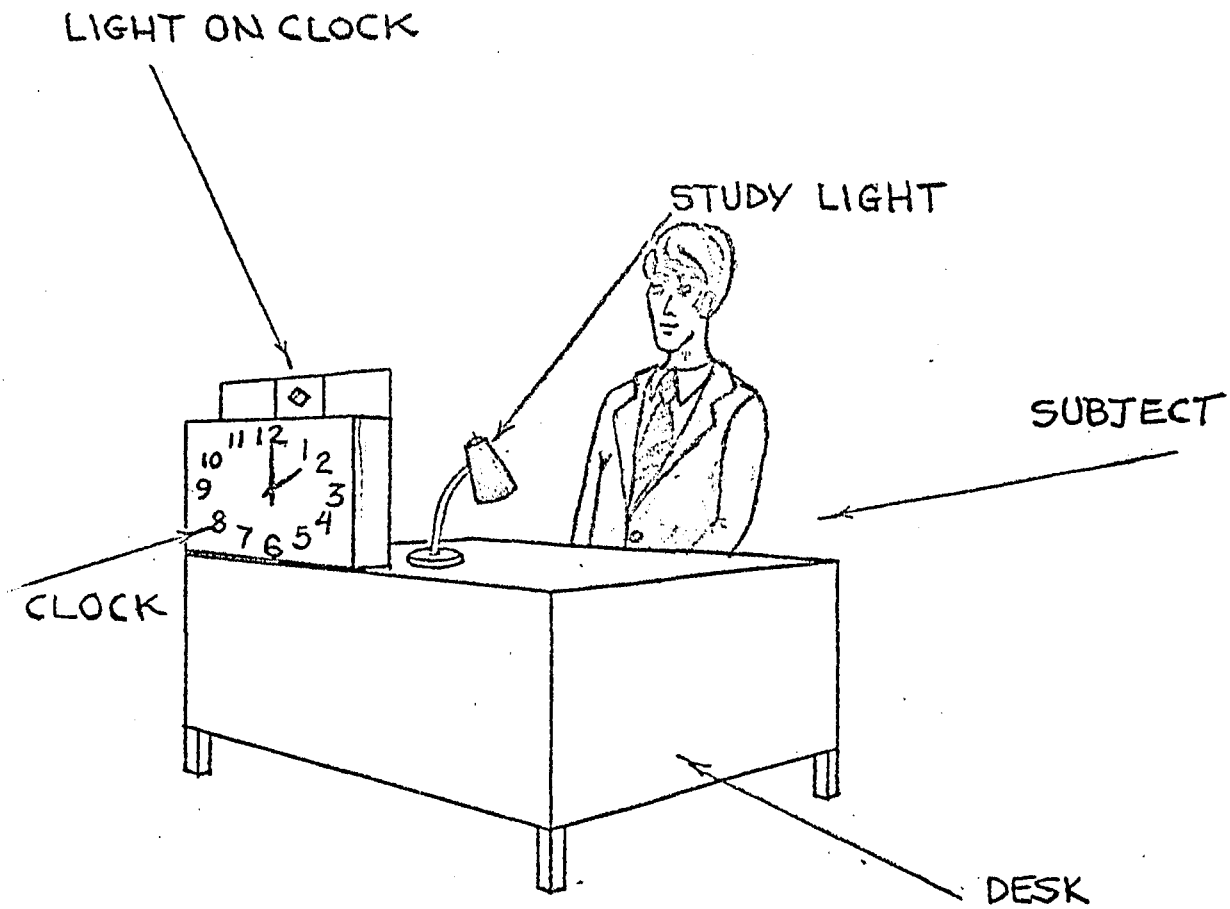


FIGURE 2. Sketch of the experimental study situation.

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. It was hypothesized that the Ss would do better on the tests if they made fewer errors in reading the appropriate topic sentences.

#### Procedure

General schedule. The Ss 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. Then in subsequent sessions, each S was required to survey the first ten chapters from Introduction to Psychology, 4th edition. Upon surveying each chapter, one at a time, he left the room to pursue his normal routine. Approximately twenty-four hours later, according to schedule, he returned to the experimental room. A test was administered to measure the effectiveness of the previous day's surveying behavior. The test complete, the S would survey the next chapter. This procedure was followed until all ten chapters were surveyed and tested. The total time required for surveying all the twenty-five chapters varied from S to S but each had eleven experimental sessions for surveying: one session for the fifteen short chapters from Study-Reading College Textbooks (both surveying and testing); and ten sessions for the ten chapters from Introduction to Psychology, 4th edition. The test on chapter ten, occurring twenty-four hours after the surveying of chapter ten, did not constitute a surveying session. It was hypothesized that operant conditioning should be effective in developing facility in the

use of surveying techniques; that reinforcement would bring survey behaviors under stimulus control.

Independent Variables. The following two experimental surveying conditions served as the independent variables: (1) Condition R. In this condition the two Ss 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) Condition NR. In this condition the two Ss chosen at random to receive no reinforcement did not receive reinforcement (i.e., the study light remained off) although they were emitting desired survey behavior. It was hypothesized that condition R would increase the frequency of appropriate surveying more than would NR.

Dependent Variables. The following four factors served as the dependent variables: (1) errors of omission during acquisition trials 1-636, namely, not reading correct topic sentences; (2) errors of addition during acquisition trials 1-636, namely, reading inappropriate topic sentences; (3) test responses (corrected for guessing) on the 25 tests taken; and (4) time required to complete the surveying of the 25 chapters.

Data were collected for each S individually in his respective learning condition (either R or NR), and for sake of comparability have been transformed into percentages.

Although not statistically analyzed, data are shown (see Tables 18 and 19) representing the ratio of appropriate surveying time to total surveying time.

Since an error or omission (not reading an appropriate topic sentence) required no time, it was possible to record that 100% of the actual time spent surveying was spent emitting appropriate behavior. Analysis of the

total number of topic sentences read compared to the total number required was a more realistic measure of the appropriateness of the survey behavior. That measure was chosen as one of the dependent variables, rather than the proportion of the sessions during which desired behavior was emitted.

### Experimental Design

Reese (1966) outlined and described a "behavioral model for learning" (p. 49). This model has been utilized due to its soundness and workability. Her model was altered, however, where current procedures militated against its usefulness. The following ten subpoints, adapted from Reese's model, constitute the design of this present experiment.

1. Specify the final performance, that is, identify the terminal behavior.

A chained performance emitting survey behaviors was established as the terminal behavior. The subject matter of this terminal survey behavior was the topic sentences in the twenty-five chapters from the two books mentioned under the above section entitled Apparatus and Physical Environment, page 17. In the case of these terminal subject matter usages, the requirement was that the student must read aloud systematically all bold-faced headings and the first sentences in the reading assignments of the treatment material mentioned above.

2. How is the terminal behavior to be measured?

By video-taping the subject through the screen's opening into the experimental study room, the Es were able to observe by the TV monitor and hear by the earphones the survey of the work increments. Continual observation was recorded by videotape.

Whether the subject had completed all required reading for the experimental treatment was determined from previous survey performances in the experimental study room. The video taped record of the clock in the experimental room was analyzed to measure the number of minutes of appropriate surveying behavior during the eleven sessions. Beginning time was subtracted from the ending time to obtain these data. A record of acquisition errors also was tallied by the Es. The light on the clock was turned on by the Es whenever appropriate survey behavior was emitted.

In the case of the reinforced Ss (condition R), whenever the appropriate surveying behavior was emitted, the study light on the desk was turned on by the E from a remote switch at the E station in an adjoining room. The study light was synchronized with the light on the clock in the case of the reinforced Ss; therefore, when the study light came on, the light on the clock came on also. The video tape recorded both lights under condition R. The tapes were analyzed later for the number of times survey errors occurred during acquisition trials 1-636.

Under condition NR, the study light did not come on when the appropriate survey behavior was emitted, but the light on the clock did. This prevented the NR Ss from knowing when their behavior was appropriate, yet allowed accurate recording of that behavior. Appropriate behavior was clearly signalled by the clock light; and, by use of the video tapes, was analyzed by reading the beginning and ending times. The exact time of each appropriate emission of survey behavior was also discerned.

### 3. Determine the operant level or current baseline.

The subject's current operant level was measured by observing

performances emitted in the experimental study room before treatment started. He was observed by monitored video tape for one hour. This baseline session was analyzed for the number and duration of emitted behaviors considered to be desirable, especially in comparison with the terminal behaviors.

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, however, that the Ss emitted no behavior that was similar to the survey behavior considered appropriate. The Ss were asked to study a specific chapter in a textbook in preparation for a test over that material. They were asked to study as they normally would. Without exception, the Ss opened the book to the appropriate chapter and began reading at its beginning until time was called. At no time did any of the Ss look ahead to see how many pages were in the work unit, or what the content of the chapter revealed in terms of type-face, charts, or formulas. The Ss's baselines were identical in terms of uniform lack of appropriate survey behavior.

Since all four Ss had virtually identical baseline survey behavior (with no appropriate emissions), they were chosen by a stratified random procedure to be reinforced or non-reinforced, that is, one male and one female were chosen by the toss of a coin. These were reinforced, and the other two Ss were assigned to condition NR. This assignment to groups was done after all Ss had viewed the video taped recording demonstration of the survey behavior which was 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 video taped in the experimental room at the study desk (see Appendix C). 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 Ss 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 Ss 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 Ss was required to view (by video tape playback through a TV monitor) 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 by the Ss, the principal 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, each S stated precisely what the appropriate topic sentences were, what constituted inappropriate topic sentences, and that they should read aloud, stating when they thought they were through by saying that they were ready to take the test over that material. After

summarizing in their own words what they were to do, the principal investigator was convinced that each S knew what was expected of him.

After setting up a schedule for surveying the fifteen chapters in Study-Reading College Textbooks, each S left. After interviewing all the Ss, the principal investigator tossed a coin to determine which two Ss would be assigned to R (to receive reinforcement). After one boy and one girl were selected to R by the coin tosses, the other two Ss were assigned to NR (not to receive reinforcement).

When the S came to the first session as previously arranged, he was reminded only to do what he had been instructed to do on the tape. He was told, further, where the tests were located and where to put them when finished.

The first S on the schedule was the NR female, and the second one was the NR male. The third S on the schedule was the R female, and the fourth S was the R male.

The two R Ss were instructed prior to beginning their first work increment about the mechanics of reinforcement. They were told, as were the other two Ss (the NR Ss), to do what they were told to do on the tape. Unlike the NR Ss, the R Ss were told that when they surveyed in the appropriate manner the study light on the desk would come on, signifying that they were doing is just right--that they were doing a good job. They also were told that if they omitted a proper topic sentence, or read an inappropriate topic sentence that they would not receive reinforcement (either the study light would not come on, or would go off if it had already been on). Both R Ss were asked to state in their own words what

it meant when the study light came on or went off.

Of course, to have a modified control, the two NR Ss were told nothing concerning reinforcement. The desk or study light was not turned on during NR, so it was not indicative of their appropriate performance. The NR Ss were allowed to proceed through each session without regard to whether their behavior was appropriate. The clock light, under control of the Es, came on for the NR Ss whenever they emitted the desired behavior, but the Ss did not know it. The clock light was used for measurement when comparing the behavior of the NR Ss with that of the R Ss. The Es knew which Ss were in R and NR.

#### 4. Structure a favorable situation.

The situation for development of the desired operant behavior was an experimental study room (described above in Figures 1 and 2, and under Apparatus and Physical Environment on page 17) under control of the experimenter. The room was well-lighted, with a study desk and a desk light.

One possible distracter was an opening in the divider screen through which video taping and direct observation was done. This opening was located across the room from the Ss. Another possible distracter was the clock sitting on the study desk in front and to the right of the Ss. A microphone was located in the clock and therefore was useful, but not visually distracting.

It was readily apparent that the Ss were aware of the experimental nature of the situation under which they were to study. As the sessions continued, however, they seemed quite matter of fact as they entered, took

the test, and surveyed the next work unit. Although the study situation was atypical for the Ss, they all adjusted well. No one S was affected more unfavorably than another.

It occurred to the Es that the audio playback indicated a possibly distracting level of noise from the hallway (outside the door to the study room) as students walked by from classes, but the audio technician explained that a sensitive microphone picks up more general noise than the human ear. The Es asked the Ss if they noticed any particular distraction only to find that, if anything, the experimental room was too quiet (i.e., there was no soul music playing on a radio).

Actually, the experimental room seemed to be a favorable situation as it was structured to be.

5. Discriminative stimuli for appropriate behavior: condition R.

These chained performances constitute the operant--

<u>OCCASION (Sd)</u>	<u>PERFORMANCE</u>	<u>REINFORCER (Sr)</u>
a. Presence in the study room at appropriate time.	Sitting at desk with book open to suitable place.	Sight of first page of work increment.
b. Book open to appropriate place: sight of first page of work increment.	Survey of SQ3R: (1) Turning pages of work increment, as required. (2) Saying aloud the words that constitute the bold-type subheadings. (3) Reading aloud the first sentence following the subheading title.	Sight of headings and desk light comes on (signifying that reinforcement is being applied).

Of course, under condition NR the Ss were not reinforced, but when appropriate survey performances were emitted the clock light was turned on for a later tabulation of correct behavior.

6. Remove opportunity for incompatible behavior.

This was accomplished to a great extent since there were few distractors in the experimental study room. When incompatible behavior was emitted, the study light, used to signify reinforcement, did not come on, or if already on (which was more typical) was turned off. This was a modified aversive stimulus in that the termination of non-reinforcement increased the frequency of appropriate behavior.

If the subject began to stare at the book, yet was not reading, the light did not come on, indicating that continuation of that behavior prevented reinforcement. The major incompatible behavior that occurred was an attempt to read inappropriate topic sentences or omit appropriate ones. An aversive stimulus reduced the opportunity for incompatible behavior in that the desk light was not turned on when undesirable behavior was emitted.

7. Establish motivation.

- a. Locate reinforcers: Events which increase the frequency of the performance they follow.

The study light, which came on when appropriate behavior was emitted, was the reinforcer. It was the reinforcement, in that it followed the appropriate performance. In this study, it is said that the R Ss were under stimulus control of the light. Further, the light was the reinforcing stimulus in that it set the occasion on which the light might remain lit. The study light remaining on was also the reinforcement, in that it followed the performance of appropriate surveying. It was most

typical of the experimental condition that the study light was on.

b. Deprive, if necessary.

Under experimental control, when improper behaviors were emitted, the light was turned off, indicating that positive reinforcement was not possible. This withholding of positive reinforcement was a modified aversive stimulus, as mentioned above. This withholding altered the frequency of surveying behavior. Occasional whispered exclamations were picked up by the audio recorder such as "Damn", and "Now what the hell did I do wrong!" when a S was surveying rapidly and when he apparently became careless in omitting a topic sentence.

8. Shape the desired behavior (condition R only).

This aspect of the model required the experimenter to reinforce successive approximations of the final performance, raise the criterion for reinforcement gradually, and present reinforcement immediately, contingent upon the behavior. 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.

After one of these trial sessions, the final performance behaviors constituting 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 was continued (i.e., reading aloud, in order, the bold-faced headings and the first sentence under each heading) the light remained on. At the completion of a work increment, the S said that he was ready to take the test over that chapter. Before going on to the next work increment in the material to be studied, the light went out and the S was required to take an objective test covering the last work increment.

The initial work increment was a short chapter (Chapter One) in Study-Reading College Textbooks. It had only six topic sentences. The

next fifteen chapters increased slightly in content difficulty, although the number of topic sentences varied, and did not necessarily increase in difficulty. For the fifteen work increments in Study-Reading College Textbooks, the Ss were allowed to take the test covering the topic sentences immediately upon completion of the survey. The tests were turned face down, in order, next to the desk. When a chapter was completed, the S announced that he was ready to take the test. Then he closed the book, pushed it aside, and took the test (from the stack next to the desk) and completed it. Then he said, "I am ready for chapter \_\_\_\_." He would re-open the book and begin surveying the next chapter. This continued for the fifteen chapters. It was explained to the Ss, after surveying the first book, that the next book (Introduction to Psychology, 4th edition) would have longer chapters and that each test would not be taken for 24 hours after the chapter had been surveyed. In this way, the criterion for reinforcement was raised.

The Ss came to the experimental room on a scheduled basis for ten separate sessions to survey the second book. After surveying Chapter One in the second book, the Ss announced that they were through with that chapter and left the room. When next scheduled to return, approximately 24 hours later, the Ss took the test covering the previous chapter surveyed and then began to survey the next chapter until all ten chapters were surveyed and tested.

This series of chapters was begun on a Monday; therefore, the test covering the chapter surveyed on Friday (Chapter Five) was not taken until Monday. The same thing occurred with Chapter Ten. Instead of the normal

24 hour time out between surveying and testing these two chapters were taken after 72 hours, making them more difficult.

Further, in keeping with the operant model, reinforcement was applied immediately in that the study light was turned on by the Es when the appropriate behavior was emitted.

This experimental design hypothesized that a lecture on survey behavior, after modeling, followed by reinforcement would be more efficacious than a lecture on survey behavior, after modeling, without reinforcement. This basic hypothesis was to be investigated by considering the following:

(1) Surveying behavior could be brought under stimulus control by use of the desk light.

(2) The reinforced Ss would emit more desirable survey behaviors than would non-reinforced Ss, in that the R Ss would omit fewer appropriate topic sentences, and would read fewer inappropriate topic sentences.

(3) The reinforced Ss would do better on the tests covering chapters surveyed than would the non-reinforced Ss, that is, R Ss would (a) mark as correct topic sentence ideas more keyed responses on the tests and (b) mark fewer incorrect responses.

9. Utilize stimulus control.

At first, it was thought that the R Ss should take less time to survey the required work increments than would the NR Ss. After the first session, however, it became readily apparent that it was virtually



impossible for the R Ss to take less time to survey. Quite the contrary, it would almost inevitably require more time. Since the NR Ss were not under stimulus control, their acquisition errors, though noted, were less costly in terms of time. Errors of omission reduced the total time required for the NR Ss to survey a work increment. The R Ss, on the other hand, were under stimulus control. When they omitted a topic sentence, the light went off. So 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 R Ss time (they had to go back and try again), they almost inevitably took longer to survey a work unit than did the NR Ss.

10. Keep continuous objective records.

It has been alluded to that video taping was utilized during the experiment. The sessions to determine the baseline of each S were recorded. The lecture by the principal investigator was recorded, as well as all eleven experimental sessions. These video tape recordings were kept throughout the entire experiment. The baseline tapes and the experimental sessions were later analyzed for purposes of statistical comparison.

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 video tape 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 Ss. They were scored by the Es to determine the number of correct and incorrect responses marked.

## CHAPTER III

### RESULTS

The results of the experiment are presented in four sections. Section one is a comparison of error percentages of acquisition omissions under two learning conditions during surveying. Section two is a comparison of error percentages of acquisition additions under two learning conditions during surveying. The third section is a comparison of test score percentages under two learning conditions after surveying. The fourth section is a comparison of surveying time under two learning conditions.

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 Ss under learning condition R, with each of the two Ss under learning condition NR.

#### 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. R Ss might have omitted a sentence, returned to the appropriate sentence

preceding 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. RS1 was compared to NRS1 (Comparison A) and also to NRS2 (Comparison B). RS2 was compared to NRS1 (Comparison C) and to NRS2 (Comparison D).

Table 17 presents a summary of the 4 statistical comparisons for each of the 4 dependent variables, totalling 32 analyses.

As each dependent variable is discussed, the results of each comparison is treated separately. Also the results found in session one are discussed separately from those in sessions 2-11.

Session one. Table 1 presents the group average percentage and individual percentage of acquisition omissions under the two learning conditions, R and NR, over the 15 chapters in session one. Figure 3 demonstrates the extensive design comparing the individual Ss under each of the two learning conditions, R and NR.

Comparison A. Note that in all 15 chapters, with one exception, RS1 made a lower percentage of acquisition omissions than did NRS1. In 11 of the 15 chapters RS1 made no acquisition omissions (0%), whereas in all chapters NRS1 made at least 9% errors. Analysis of variance showed that RS1 omitted significantly fewer appropriate topic sentences than did NRS1, as hypothesized (see Table 2A).

Since neither individual emitted any desirable survey behavior

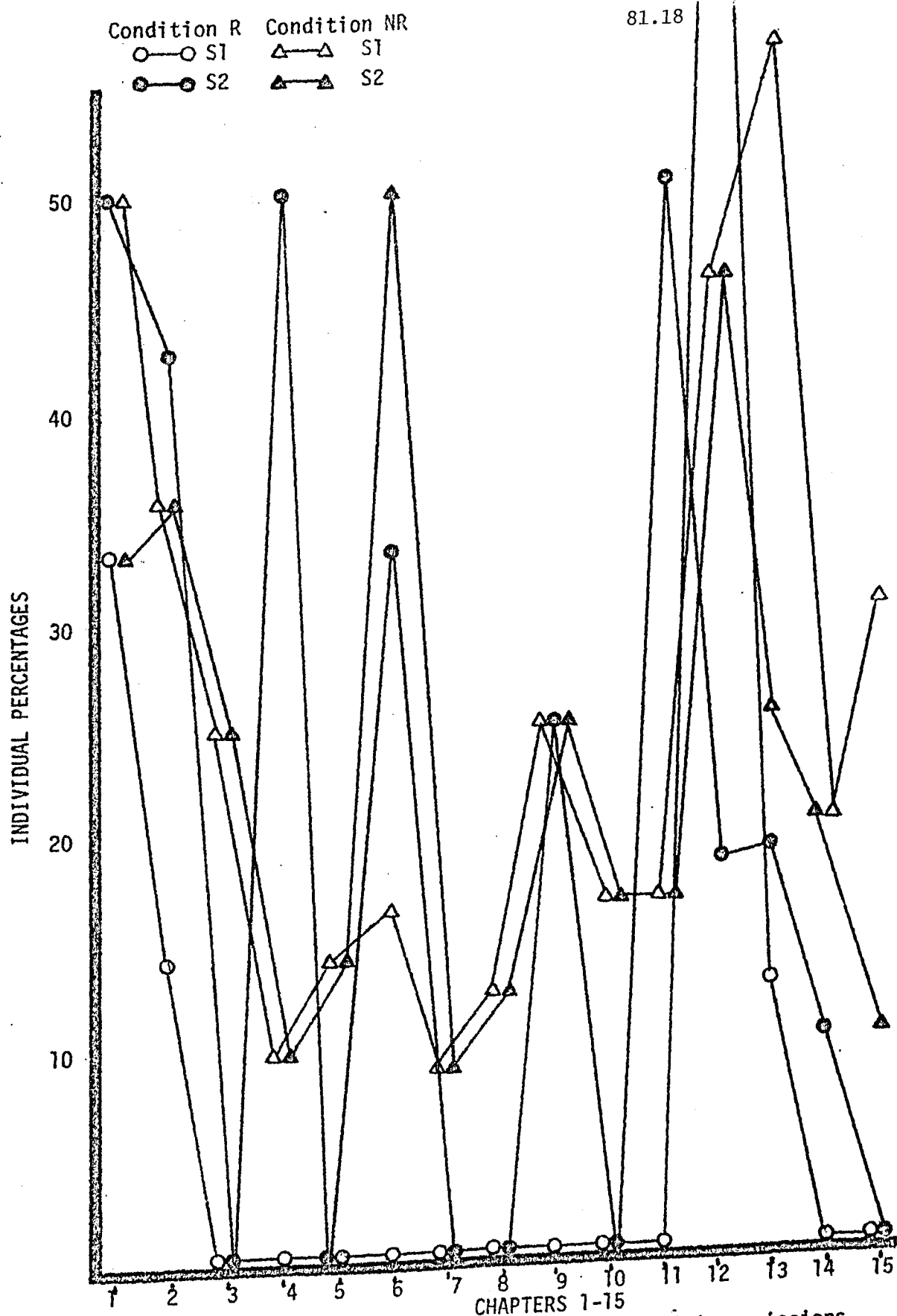


FIGURE 3. Comparison of individual percentage of acquisition omissions under two learning conditions over the 15 chapters in session one.

during the pre-experimental baseline session, it can be concluded that the independent variable (condition R) effected the difference in individual percentage of survey omissions.

Comparison B. Note that as in Comparison A, RS1 made a lower percentage of acquisition omissions, in all but one chapter, than did NRS2. In 11 of the 15 chapters, RS1 made no acquisition omissions (0%), although in all chapters NRS2 made at least 9% errors. Analysis of variance showed that RS1 omitted significantly fewer appropriate topic sentences than did NRS2, as hypothesized (see Table 2B). It may be concluded that the learning condition R effected the difference in individual percentage of survey omissions.

Comparison C. Note that in 6 of the chapters RS2 made no omissions, whereas NRS1, as noted before, made at least 9% errors. In only 6 chapters did NRS1 make fewer acquisition errors than did RS2. Analysis of variance showed that, as hypothesized, RS2 omitted significantly fewer appropriate topic sentences than did NRS1 (see Table 2C). This difference can be concluded to be the result of the learning condition R.

Comparison D. It may be noted that in only 4 chapters did RS2 make fewer acquisition omissions than did NRS2. It was hypothesized that RS2 would have a lower percentage of acquisition omissions. Analysis of variance showed a significant difference, as hypothesized, (see Table 2D). The difference was attributed to learning condition R.

Sessions 2-11. Table 3 presents the group average percentage and individual percentage of acquisition omissions under the two learning conditions, R and NR, over the 10 chapters in sessions 2-11. Figure 4

demonstrates the extensive design comparing the individual Ss under each of the two learning conditions.

Comparison A. Note that in only one of the 10 chapters did RS1 make any acquisition omissions, although in only one chapter did NRS1 fail to make any omissions. NRS1 made error percentages as high as 24%, whereas RS1 made a high of only a 2% error percentage, and that was in only one chapter. Analysis of variance showed that RS1 omitted fewer appropriate topic sentences than did NRS1, as hypothesized (see Table 4A). It was concluded that the difference was attributable to the learning condition R.

Comparison B. It may be noted that in all chapters NRS2 omitted appropriate topic sentences, whereas in only one chapter did RS1 do so. NRS1's error percentages ranged from 18.5% to 32.6%. As hypothesized, RS1 made significantly fewer acquisition omissions than did NRS2, which was attributed to the independent variable (see Table 4B).

Comparison C. It may be observed that in 6 of the 10 chapters RS2 made no acquisition omissions. The highest error percentage was only 4.5 for RS2, yet for NRS1 it was 24. Analysis of variance showed that RS2 made significantly fewer acquisition omissions than did NRS1, as hypothesized (see Table 4C). It was concluded that learning condition R effected the difference between the two Ss.

Comparison D. It is to be noted that in all chapters NRS2 omitted appropriate topic sentences, ranging from error percentages of 18.5 to 32.6. In all chapters RS2 made fewer omissions than did NRS2.

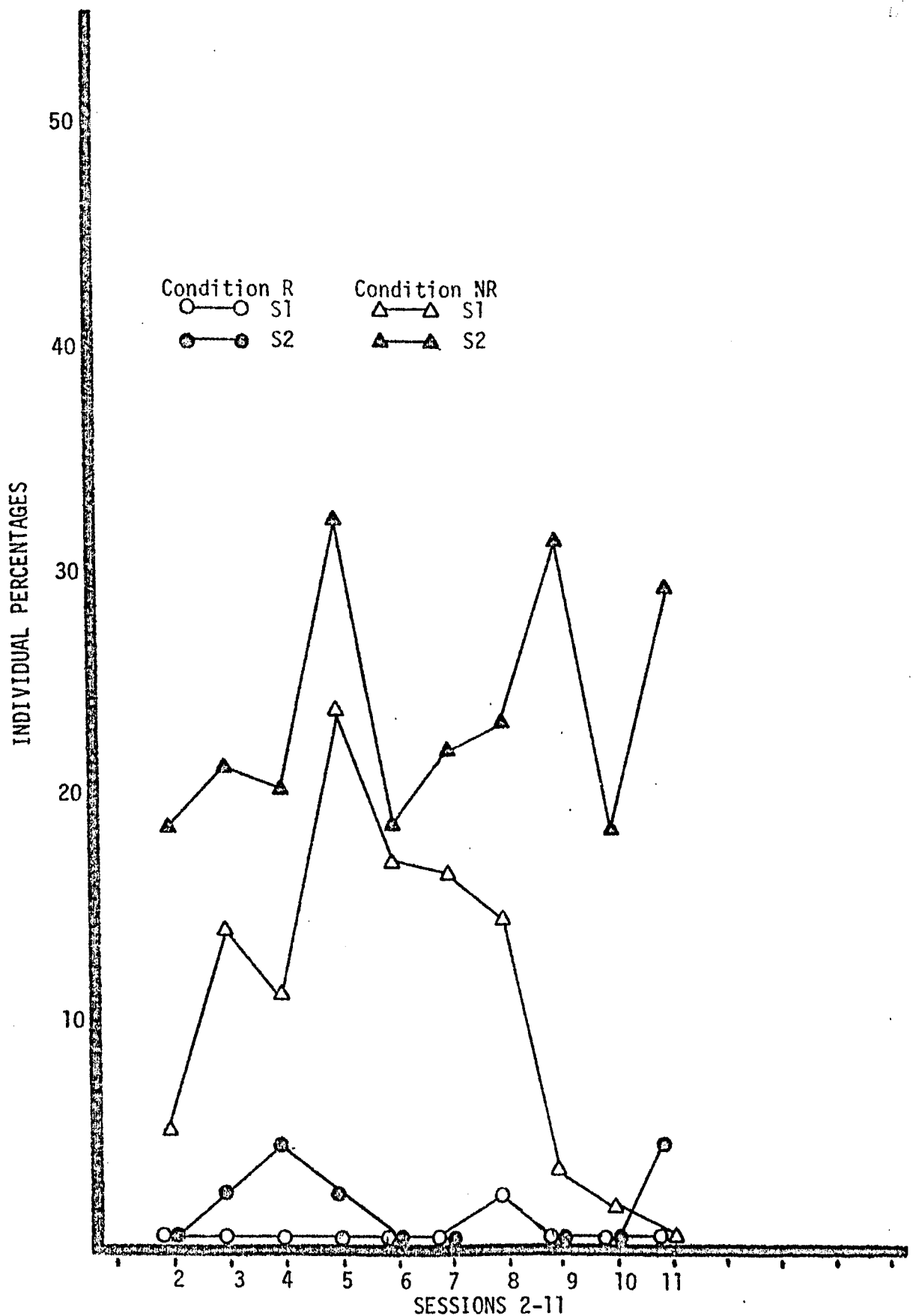


FIGURE 4. Comparison of individual percentage of acquisition omissions under two learning conditions over the 10 chapters in sessions 2-11.

Analysis of variance showed, as hypothesized, that RS2 omitted significantly fewer appropriate topic sentences than did NRS2 (see Table 4D). Learning condition R was concluded as attributing to the difference.

#### Acquisition Additions

Acquisition additions were defined as any vocal response while surveying which did not constitute an appropriate topic sentence. They differed from omissions in that while omissions were by-passing or leaving out appropriate material, additions were vocal responses which constituted inappropriate topic sentences. The two errors were different in kind.

Session one. Table 5 presents the group average percentage and individual percentage of acquisition additions under the two learning conditions, R and NR, over the 15 chapters in session one. Figure 5 demonstrates the extensive design comparing the individual Ss under each of the two learning conditions, R and NR.

Comparison A. It is to be noted that RS1 made no acquisition additions in 9 of the 15 chapters in session one, yet NRS1 made none in 13 of the 15. RS1 made more errors of surveying addition at first than toward the last chapters, whereas NRS1 began with 0%, went up to 14%, and returned to 0%. It was hypothesized that RS1 would make fewer acquisition additions than would NRS1. Analysis of variance showed no significant difference between the Ss (see Table 6A).

Comparison B. Note that in 11 of the 15 chapters NRS2 made no acquisition additions, whereas RS1 made 0% additions in only 9 of the



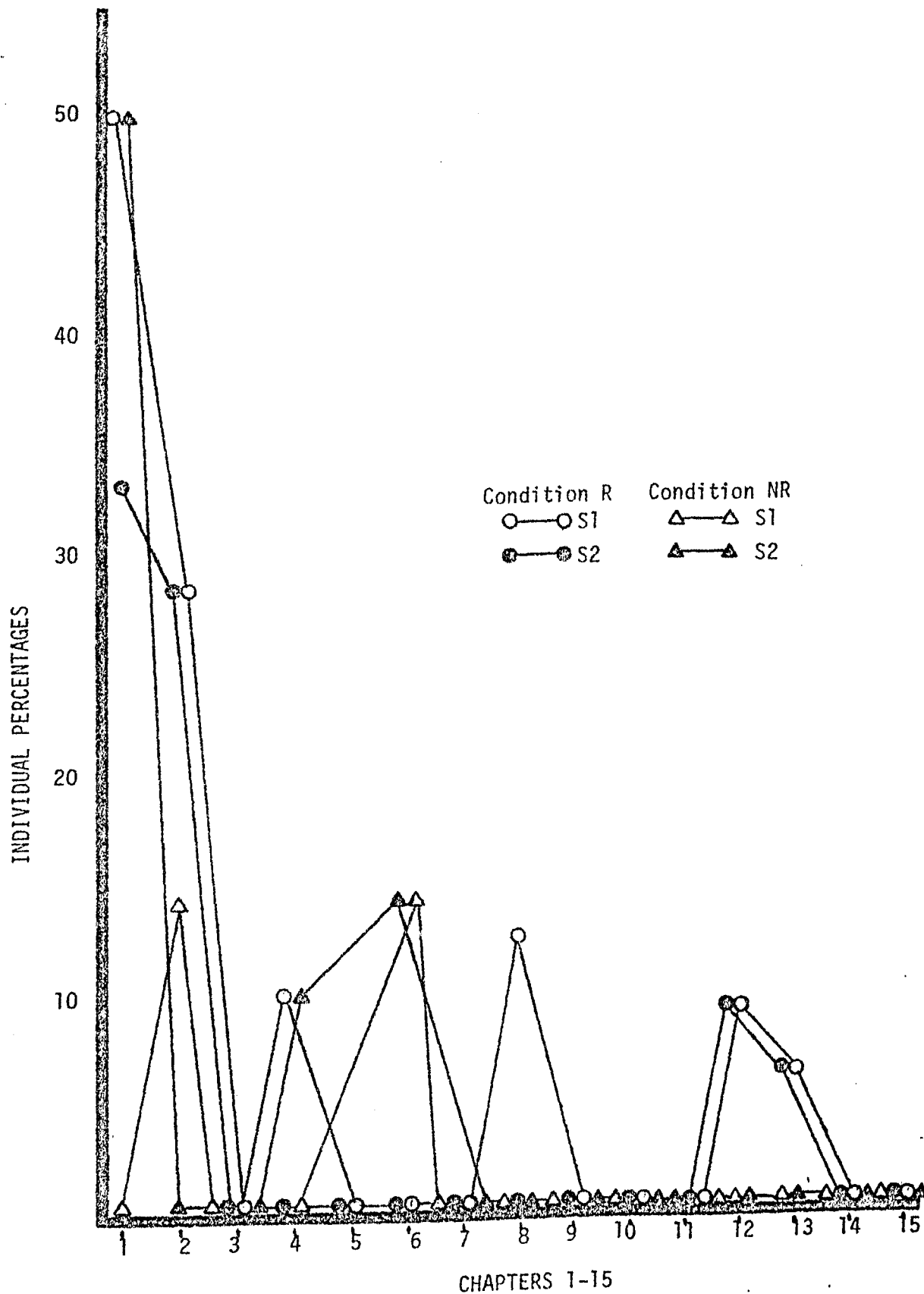


FIGURE 5. Comparison of individual percentage of acquisition additions under two learning conditions over the 15 chapters in session one.

15. Both Ss started with 50% additions and ended with 0%. In only two chapters did RS1 make fewer errors than NRS2. It was hypothesized that RS1 would make fewer acquisition additions than would NRS2, yet the analysis of variance showed that there was no significant difference (see Table 6B).

Comparison C. It may be noted that in 11 of the 15 chapters RS2 made no acquisition additions, whereas in 13 chapters NRS1 made 0% addition errors. For both Ss the initial errors were the highest and later there were fewer; ending with 0%. Contrary to the hypothesis analysis of variance showed no significant difference between RS2 and NRS1 in numbers of acquisition additions (see Table 6C).

Comparison D. It is of note that with the exception of three chapters RS2 made comparable or lower acquisition additions on all chapters in session one. In only 4 chapters did either RS2 have any additions. Although hypothesized as different the analysis of variance showed no significant difference between RS2 and NRS2 in acquisition additions (see Table 6D).

Sessions 2-11. Table 7 presents the group average and individual percentage of acquisition additions under the two learning conditions, R and NR, over the 10 chapters in sessions 2-11. Figure 6 demonstrates the extensive design comparing the individual Ss under each of the two learning conditions.

Comparison A. Note that in 7 of the 10 chapters RS1 made no acquisition additions, yet NRS1 made none in 9 of the 10 chapters. In only 3 chapters did RS1 make higher percentages of acquisition

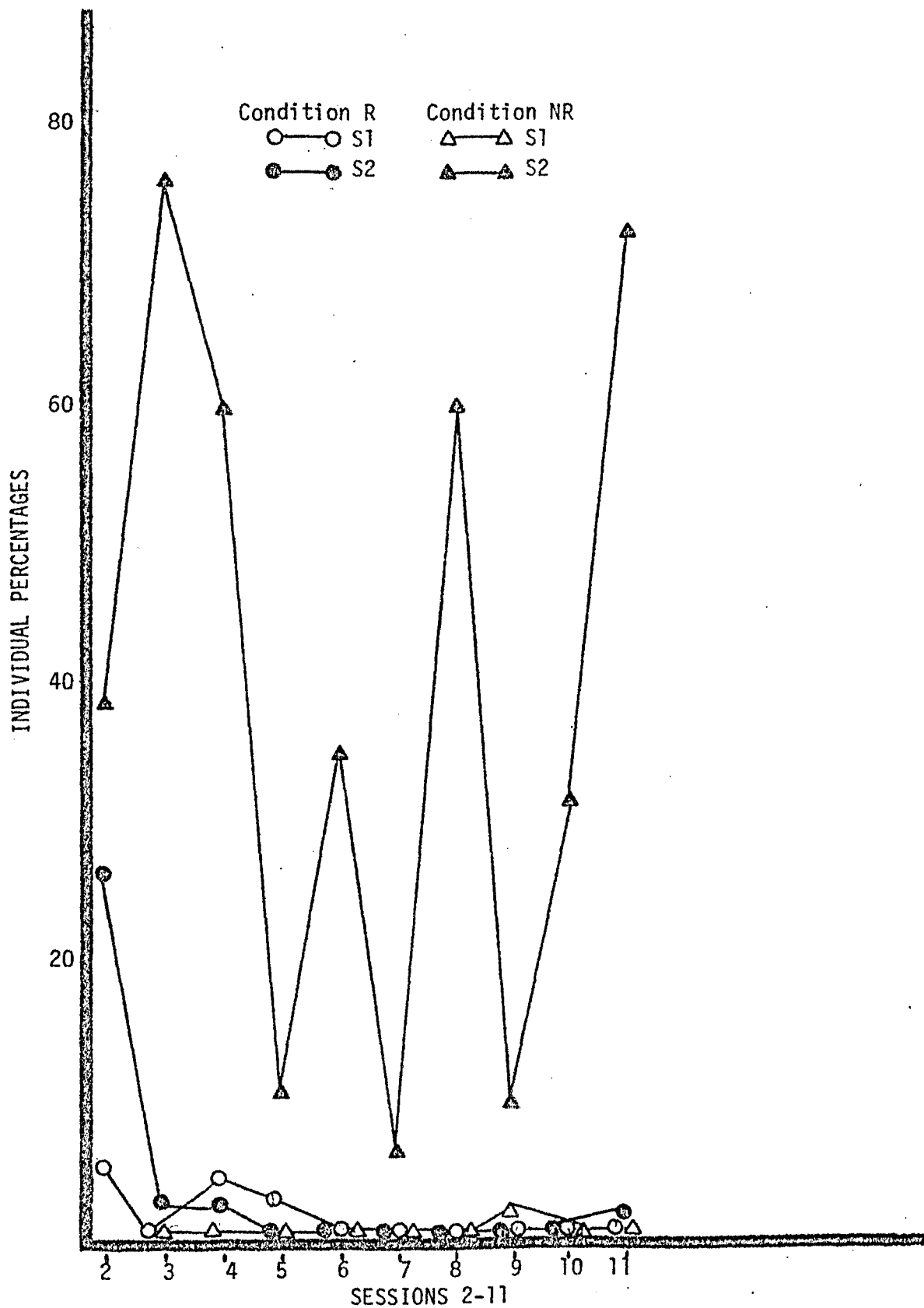


FIGURE 6. Comparison of individual percentage of acquisition additions under two learning conditions over the 10 chapters in sessions 2-11.

additions than did NRS1. However, analysis of variance showed that there was no significant difference between RS1 and NRS1 in acquisition additions, although it was hypothesized that RS1 would make fewer than would NRS1 (see Table 8A).

Comparison B. It is to be noted that in all chapters NRS2 made surveying additions, the error percentages ranging from 7.4 to 76.0, whereas RS1 made none in 7 of the 10 chapters. As hypothesized RS1 made significantly fewer acquisition additions than did NRS2 (see Table 8B). It was concluded that the learning condition R was effective in producing the difference.

Comparison C. It may be noted that RS2 made acquisition additions in only 4 of the 10 chapters, yet NRS1, as noted above, made acquisition additions in only one chapter. RS2 began with additions and consistently had none from sessions 5-10 where he erred once. It was hypothesized that RS2 would make fewer acquisition additions than would NRS1, but the analysis of variance showed no significant difference (see Table 8C).

Comparison D. Note that NRS2 made more acquisition additions than did RS2. In each session NRS2 made at least 7% error while RS2 made not only a lower percentage of error, but only erred in 4 of the 10 chapters. It was hypothesized that RS2 would make fewer acquisition additions than would NRS2. Analysis of variance showed that the difference was significant, and the hypothesis was retained. It was concluded that the learning condition R effected the difference.

#### Test Scores

Each S was tested over a chapter previously surveyed before surveying the next one. The tests contained varying numbers of 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 Ss 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 Ss who had surveyed improperly, all else being equal.

On the tests there were varying numbers of keyed items and approximately 2/3 more distracters. The tests were power tests, and all Ss had ample time to finish. According to Gulliksen (1950), "under ordinary examining conditions...the number of items marked correctly (R) will turn out to be a suitable score for the examination. This will be the case if each student reads each item and honestly tries to solve the problem before marking an answer" (p. 246). However, on objective examinations a student who does not know the answer to an item may mark it correctly by chance. Yet, "if practically all items are marked by each of the students, this effect is not a serious one and can be ignored" (p. 246). He outlines a formula for estimating the number of items for which the person knew the correct answer (p. 249):

$$\begin{array}{l} \text{number of items} \\ \text{for which the} \\ \text{answer is known} \end{array} = \begin{array}{l} \text{number} \\ \text{right} \end{array} - \frac{\text{number wrong}}{\text{number of} - 1 \\ \text{alternates}}$$

He mentions that the equation "cannot be used when items are so difficult that less than a chance proportion of those attempting the item get it correct" (p. 249). The formula also is most useful when there are blanks or unanswered multiple choice questions.

Although he feels that the number of correct test responses is "a suitable score," a penalty for guessing was decided upon, to avoid a faulty assumption. However, the above formula does not exactly apply to the current experimental tests, since it presupposes blanks and a difficulty level not too excessive. Therefore, a compromise penalty factor was chosen:

$$\begin{array}{l} \text{number of items} \\ \text{for which the} \\ \text{answer is known} \end{array} = \begin{array}{l} \text{number} \\ \text{right} \end{array} - \frac{\text{number wrong}}{\text{number of} \\ \text{alternates}} - .5$$

For each of the following comparisons test score percentages were derived by dividing the number of keyed items answered (corrected for guessing according to the formula above) by the total possible number of correct answers.

Session one. Table 9 presents the group average test score percentage and individual test score percentage under two learning conditions over the 15 chapters in Session one. Figure 7 demonstrates the extensive design comparing each of the individual Ss under learning conditions R and NR.

Comparison A. Note that in 12 of the 15 chapters RS1 scored as well or higher than did NRS1. RS1 scored 100% on one chapter and had only two scores below 50%. NRS1, on the other hand, had no perfect scores and 9 scores of 50% or below. It was hypothesized that RS1

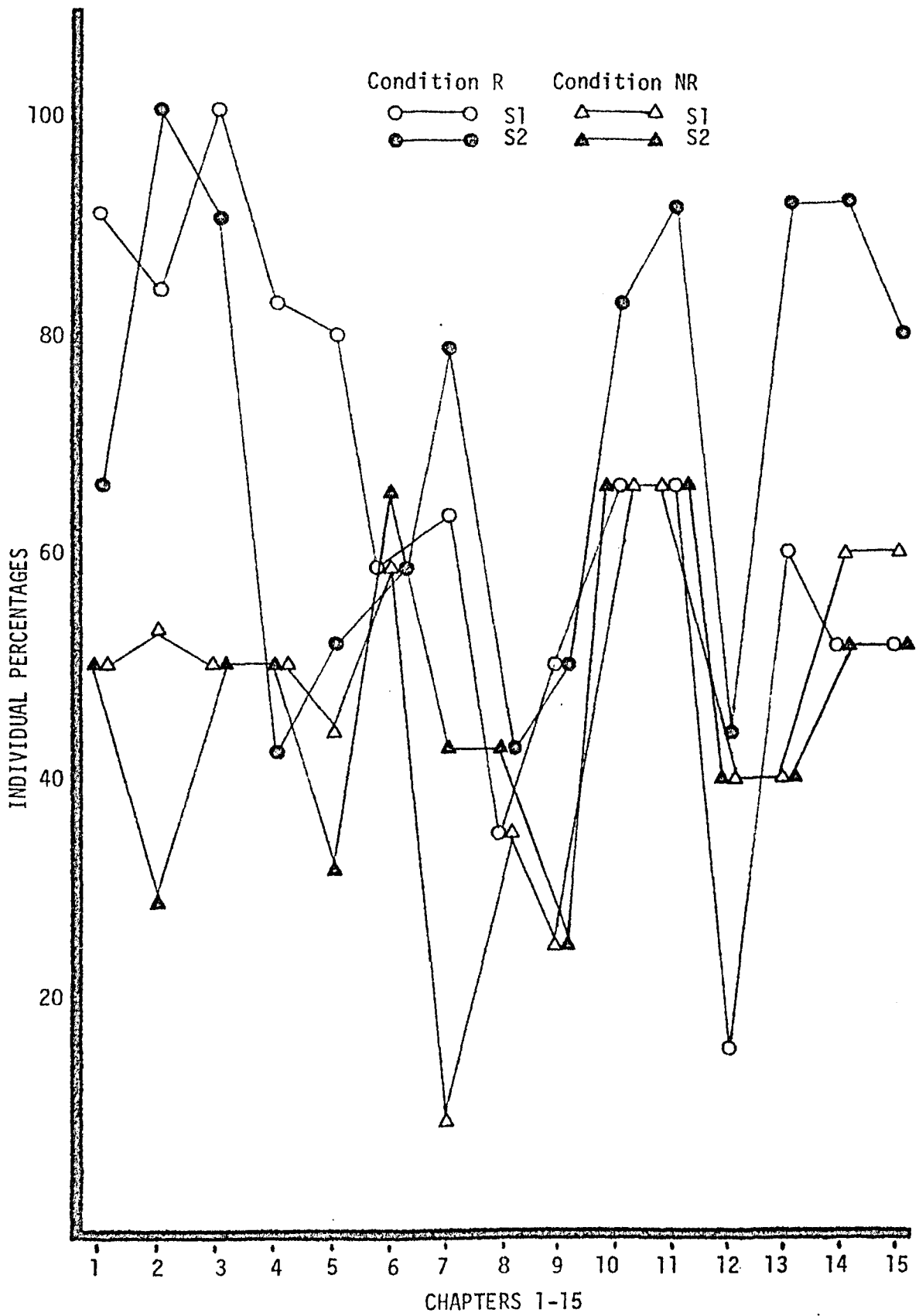


FIGURE 7. Comparison of individual test score percentage under two learning conditions, for the 15 chapters in session one.

would score higher on the tests than would NRS1. Analysis of variance showed that RS1 made significantly higher test score percentages than did NRS1 (see Table 10A). The result, it was concluded, was attributed to the independent variable, learning condition R.

Comparison B. It may be noted that in 8 of the 15 chapters RS1 made higher test scores than did NRS1. In 3 chapters their scores were identical; and in only 4 chapters did NRS2 score higher than RS1. It was hypothesized that RS1 would have higher test score percentages than would NRS2. Analysis of variance showed a significant difference, as hypothesized (see Table 10B). It was concluded that learning condition R was efficacious in producing the difference.

Comparison C. Note that RS2 scored 100% on one chapter, whereas NRS1 made no perfect scores. In 13 of 15 chapters RS2 scored higher than did NRS1, in one they were identical, and in only one did NRS1 score higher. It was hypothesized that RS2 would score higher on the tests than would NRS1. Analysis of variance showed that RS2 made significantly higher test score percentages than did NRS1 (see Table 10C). It was concluded that the independent variable affected the difference.

Comparison D. It is of note that RS2 scored higher on 11 of the 15 chapters than did NRS2, identically on one chapter, and lower on only 3. NRS2's highest score was 80% whereas RS2 had 6 scores of 80% or higher, one of which was a 100% score. Analysis of variance showed that, as hypothesized, RS2 made higher test score



percentages than did NRS2. This difference was attributed to the effect of learning condition R.

Sessions 2-11. Table 11 presents the group average test score percentage and individual test score percentage under two learning conditions over the 10 chapters in Sessions 2-11. Figure 8 demonstrates the extensive design comparing each of the individual Ss under learning conditions R and NR.

Comparison A. Note that RS1 scored higher on 6 of the 10 chapters, and lower on 4, than did NRS1. On 4 tests NRS1 made below 17%, one of which was 0%, whereas RS1 made only one score below 29%. It was hypothesized that RS1 would make higher test score percentages than would NRS1. Analysis of variance showed no significant difference between the two Ss on test score percentages (see Table 12A). Apparently the independent variable was not effective enough to produce significant differences.

Comparison B. Note that RS1 scored higher on 9 of the 10 chapters than did NRS2. The scores on 4 of the chapters were below 17% for NRS2, whereas for RS1 only one score fell below 17%. As hypothesized, analysis of variance showed that RS1 made significantly higher test score percentages than did NRS2 (see Table 12B).

Comparison C. It is of note that RS2 scored higher on 7 of the 10 chapters than did NRS1, identically on one, and lower on 2. RS2 had only one score below 23% whereas NRS1 had 4, one of which was 0%. It was hypothesized that RS2 would make higher test score percentages

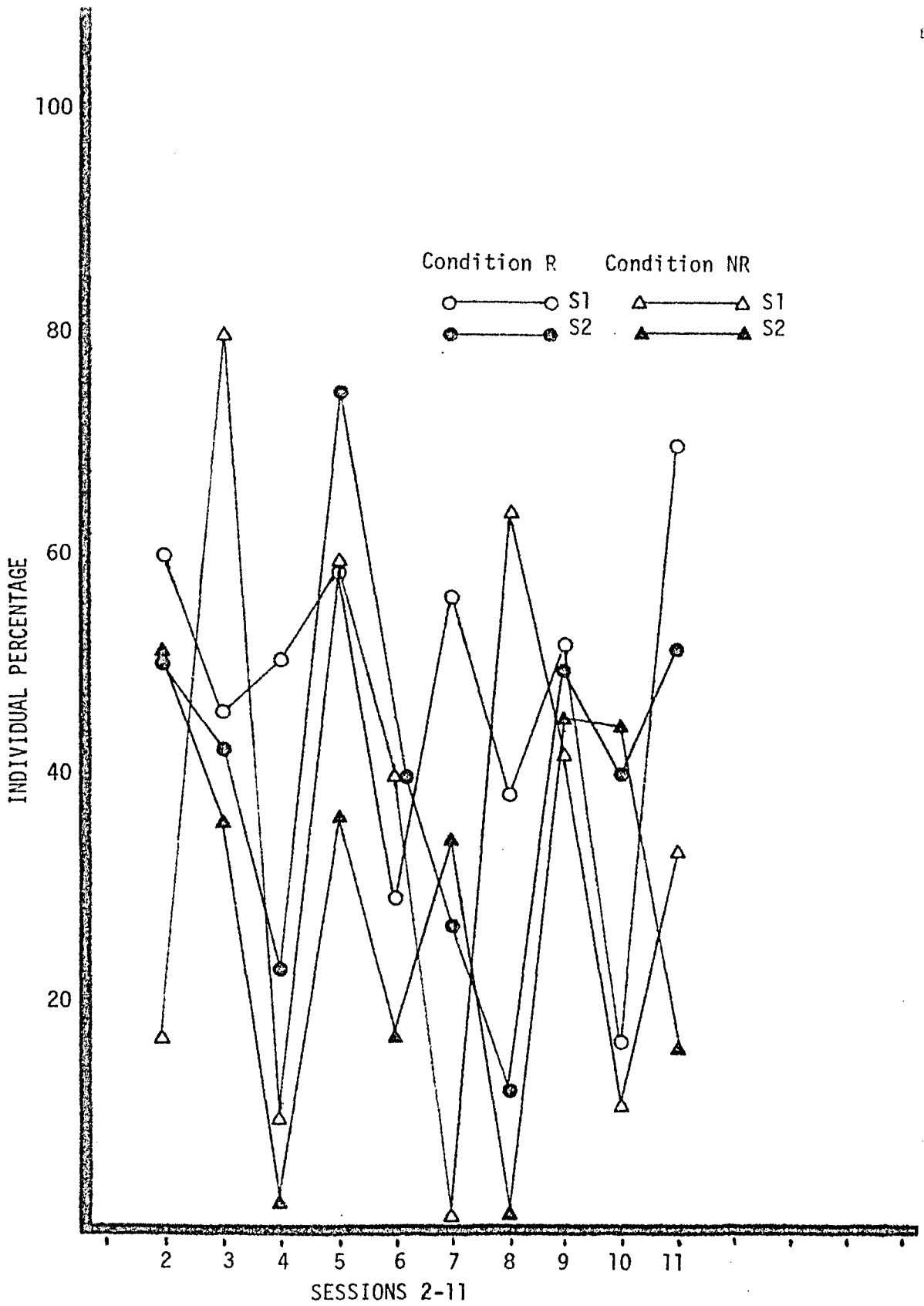


FIGURE 8. Comparison of individual test score percentages under two learning conditions over the 10 chapters in sessions 2-11.

than would NRS1. Analysis of variance showed no significant difference, however. Evidently learning condition R was not sufficiently efficacious.

Comparison D. Note that RS2 scored higher on 7 of the 10 chapters than did NRS2, and lower on 3. It was hypothesized that RS2 would make higher test score percentages than would NRS2. Analysis of variance did not support that hypothesis, however.

#### Surveying Time

Surveying time was defined as the number of seconds required for an S to survey a chapter in any given session.

Session one. Table 13 presents the group average and individual surveying time, in seconds, under the two learning conditions, R and NR, for the 15 chapters in Session one. Figure 9 demonstrates the extensive design comparing the individual Ss under learning condition R with the Ss under NR.

Comparison A. Note that RS1 took longer for surveying than did NRS1. RS1 performed at a consistently higher number of seconds than NRS1. It was hypothesized that RS1 would take less time for surveying than would NRS1. Analysis of variance showed, however, that there was no significant difference (see Table 14A). It was concluded that learning condition R was not effective in producing less surveying time required for RS1. The variance within the performance of RS1 was affected to such an extent by the surveying time for Chapter 12, that it reduced statistically, the apparent difference between RS1 and NRS1, producing a non-significant difference.

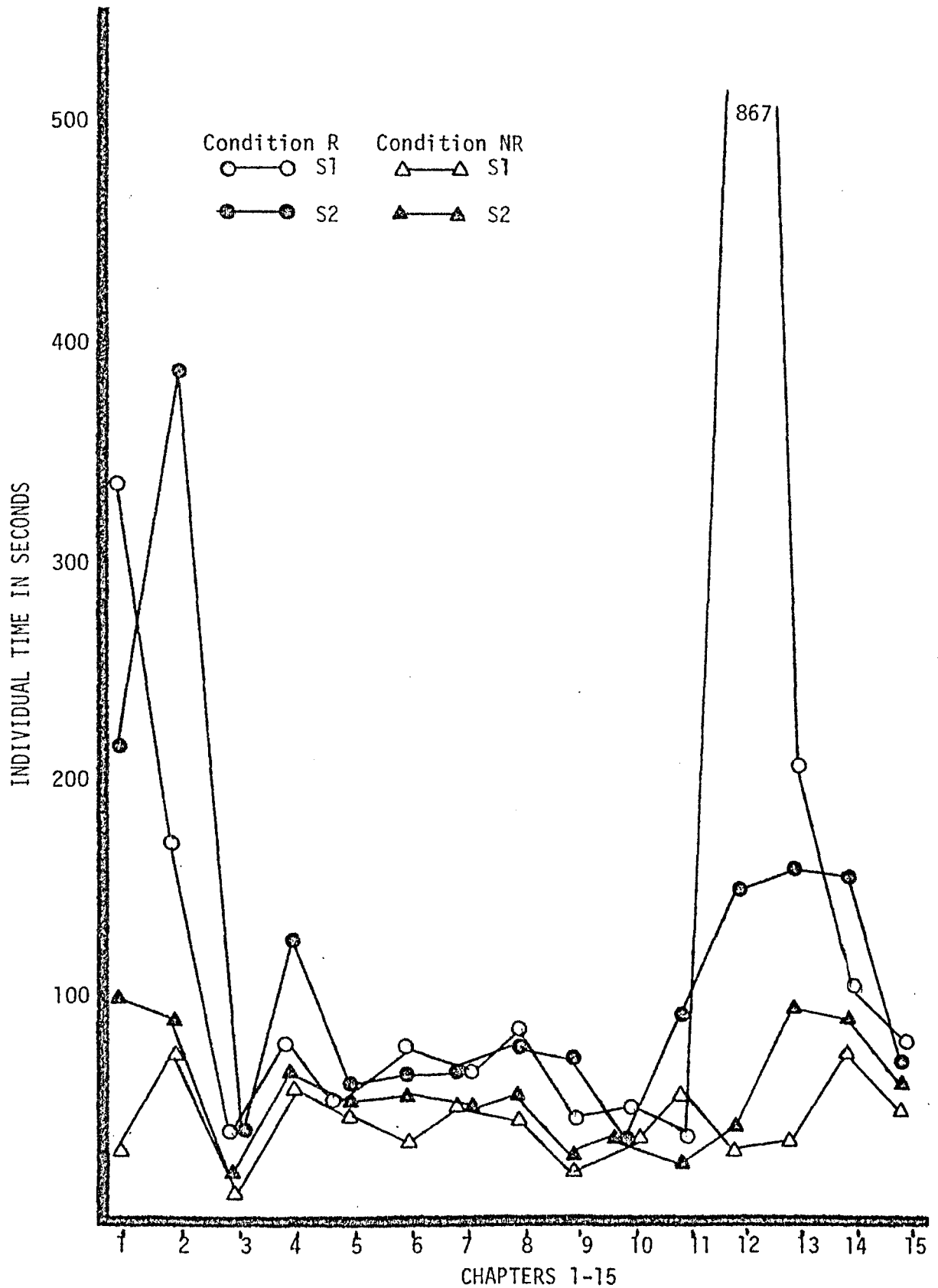


FIGURE 9. Comparison of individual surveying time, in seconds, under two learning conditions, for the 15 chapters in session one.

Comparison B. Note that RS1 took longer for surveying than did NRS2 in each of the chapters. As noted above, RS1 took inordinately longer to survey Chapter 12 than the other chapters. Therefore, although it was hypothesized that RS1 would take less time to survey than would NRS2, no significant difference was found after an analysis of the variance (see Table 14B).

Comparison C. It may be observed that RS2 took longer to survey each of the 15 chapters than did NRS2. The range for RS2 was from 38 to 386 seconds whereas for NRS1 it was from 11 to 75. It was hypothesized that RS2 would take less time to survey than would NRS1. On the contrary, analysis of variance showed that NRS1 took significantly less time to survey than did RS2 (see Table 14C). It was concluded that learning condition NR produced the difference in time required for surveying.

Sessions 2-11. Table 15 presents the group average and individual surveying time, in seconds, under the two learning conditions, R and NR, for the 10 chapters in Sessions 2-11. Figure 10 demonstrates the extensive design comparing the individual Ss under learning condition R with the Ss under NR.

Comparison A. It is noted that RS1 took longer to survey each of the 10 chapters than did NRS1. Surveying time for RS1 ranged from 409 seconds to 795 seconds whereas for NRS1 it ranged from 275 to 500 seconds. It was hypothesized that RS1 would take less surveying time than would NRS1; however, analysis of variance showed that NRS1 took significantly less time than did RS1 (see Table 16A). Learning

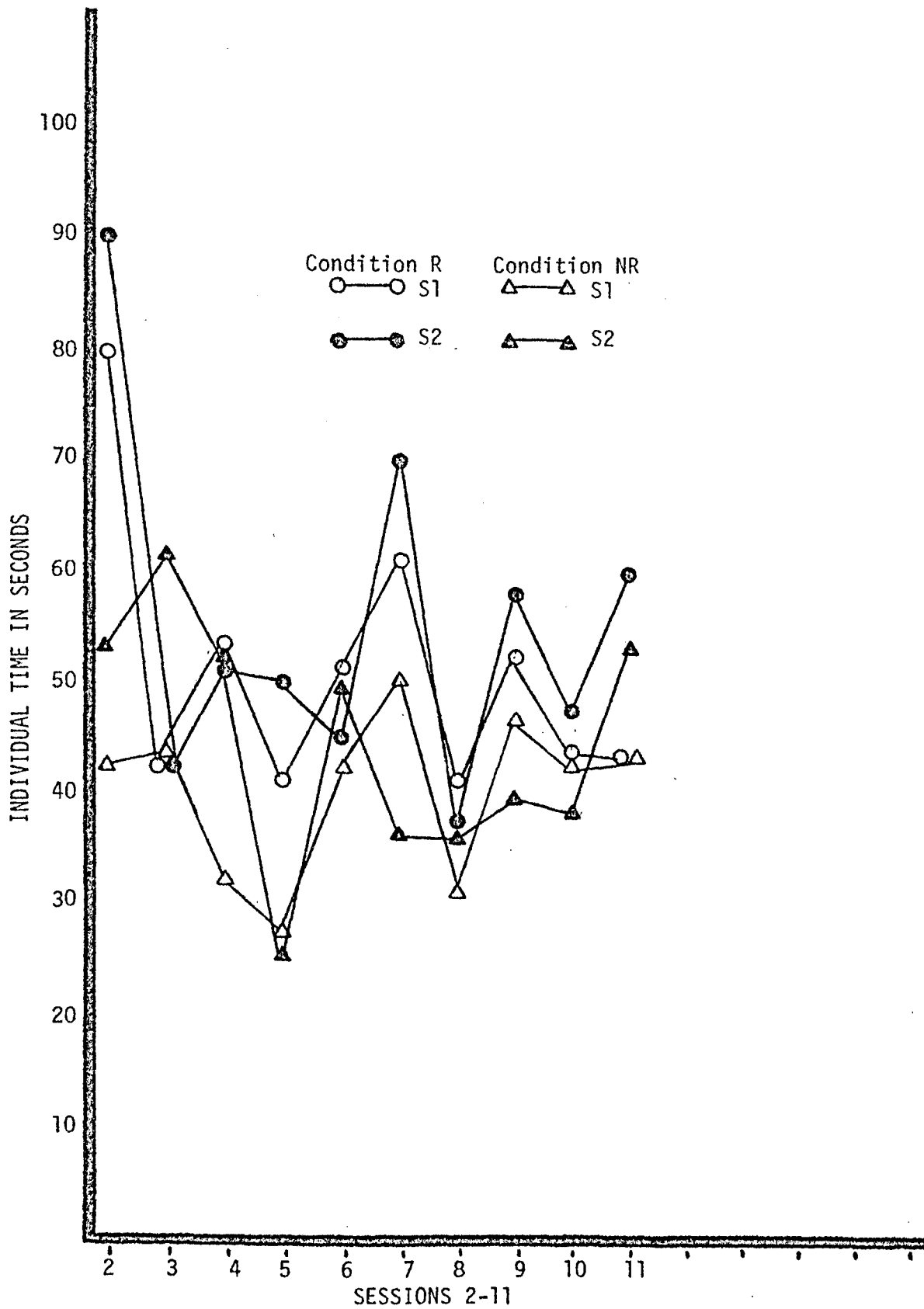


FIGURE 10. Comparison of individual surveying time, in seconds, under two learning conditions, for the 10 chapters in sessions 2-11.

condition NR produced the difference, it was concluded.

Comparison B. Note that RS1 took longer to survey 8 of the 10 chapters than did NRS2. RS1 ranged in surveying time from 409 to 795 seconds, whereas NRS2 ranged from 255 to 613 seconds. It was hypothesized that RS1 would take less time for surveying than would NRS2. Analysis of variance revealed no significant difference between the two Ss (see Table 16B).

Comparison C. It may be noted that RS2 took longer to survey 9 of the 10 chapters than did NRS1. RS2 ranged in surveying time from 373 to 899 seconds, whereas NRS1 ranged from 275 to 500 seconds. It was hypothesized that RS2 would take less time for surveying than would NRS1. Analysis of variance showed, however, that NRS1 took significantly less time than did RS2 (see Table 16C). It was concluded that learning condition NR produced the difference.

Comparison D. Note that RS2 took longer to survey 7 of the 10 chapters than did NRS2. It was hypothesized that RS2 would take less time than would NRS2. Analysis of variance revealed no significant difference between the Ss in surveying time.

#### Ratios of Appropriate Surveying Time to Total Surveying Time

This section deals with on-target surveying behavior compared to total surveying time. Appropriate surveying time was defined as the time under condition R when reinforcement was being applied, namely, when the study light was on. Total time was counted from the time the Ss emitted the first verbal response after they entered the

experimental room and opened the textbook.

Since omissions were only recorded for NR Ss, yet took no time, it was possible for NR Ss to emit correct verbal behavior 100% of the time, namely, to read all of the appropriate topic sentences and to add no inappropriate ones. In such a situation it did not mean that their total surveying behavior was 100% appropriate, but that of the total verbal behavior emitted, all was appropriate. Time ratios were not appropriate therefore, for comparative purposes between R Ss and NR Ss. For R Ss, omissions always cost them time, since they were under stimulus control and returned to read, eventually, all material previously omitted. Ratio data are presented only for Ss under condition R, where they are meaningful.

Session one. Table 18 presents the individual ratios of appropriate survey time to total surveying time under condition R over the 15 chapters in session one. Figure 11 demonstrates the comparative ratios of appropriate surveying time to total surveying time over the 15 chapters in session one.

Note that both Ss did less well in the first chapter, but maintained a high ratio afterwards. The lower ratio for RS1 on chapter 12 is unusual considering the previous and subsequent perfect ratios. The progression of ratios seems immediate and fairly consistent. RS1 made ratios of 1.00 on 9 of the 15 chapters whereas RS2 did so on 6.

Sessions 2-11. Table 19 presents the individual ratios of appropriate surveying time to total surveying time under condition R over the 10 chapters in sessions 2-11. Figure 12 demonstrates the



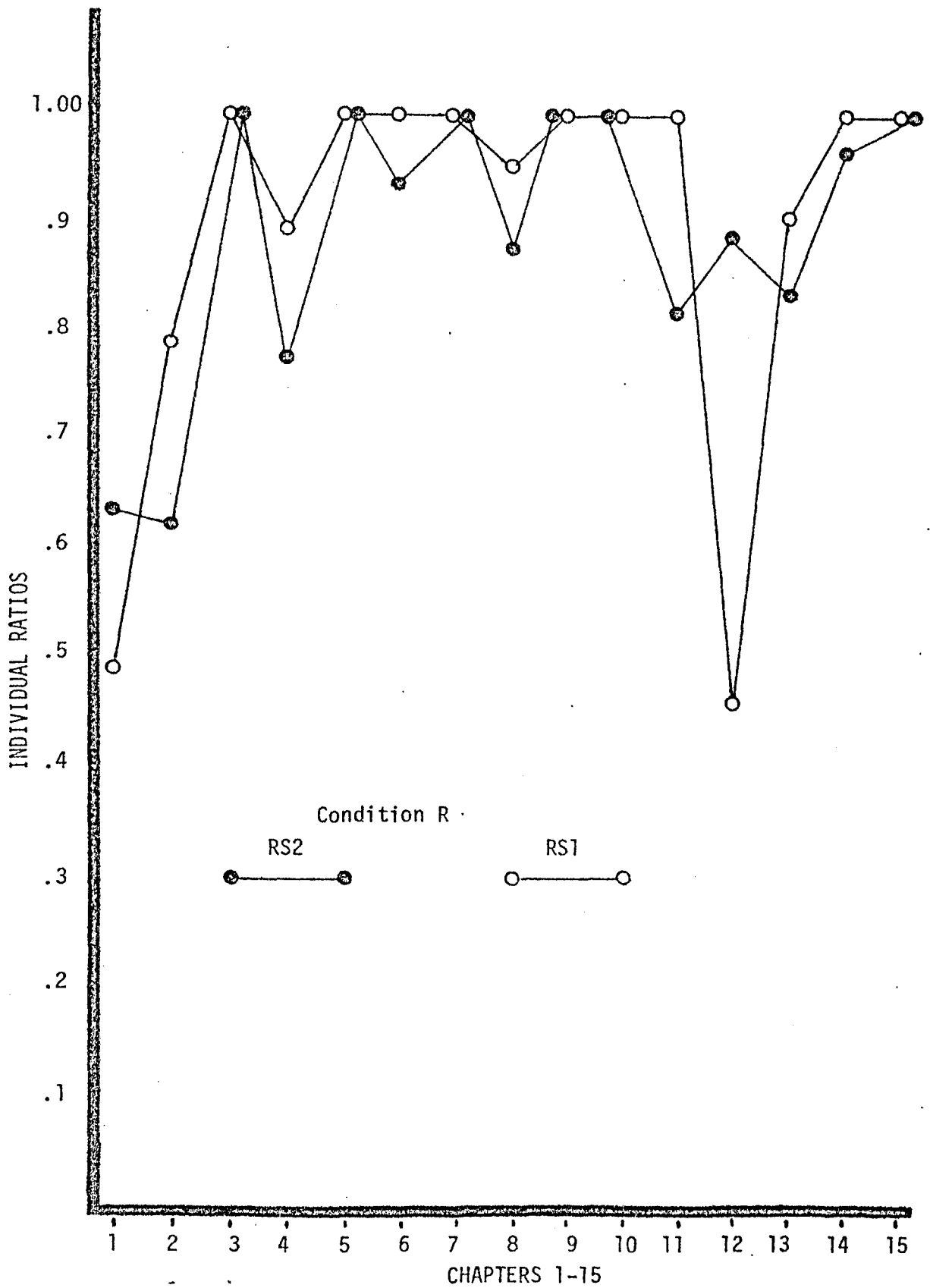


FIGURE 11. Comparative ratios of appropriate surveying time to total surveying time over the 15 chapters in session 1.

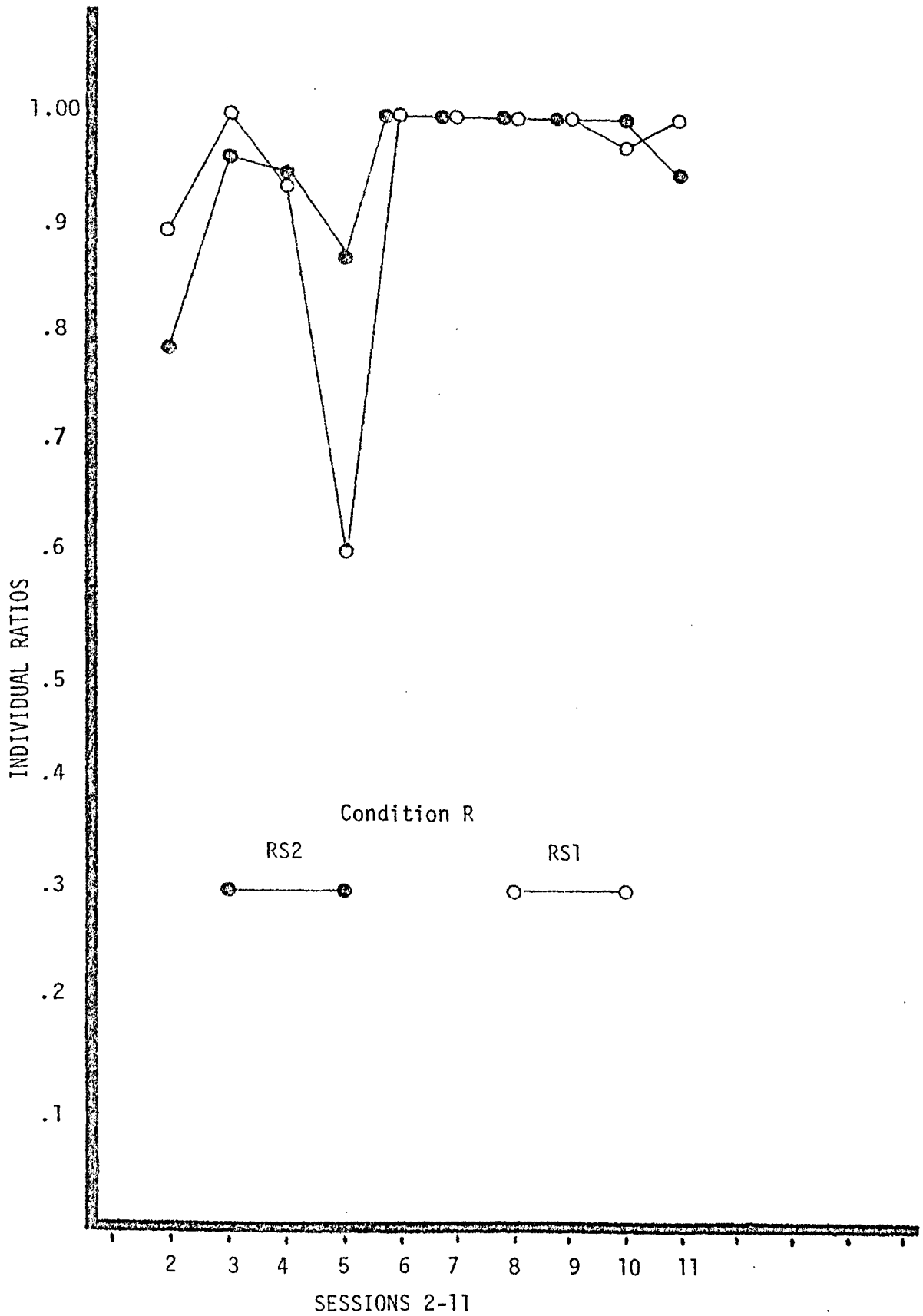


FIGURE 12. Comparative ratios of appropriate surveying time to total surveying time over the 10 chapters in sessions 2-11.

comparative ratios of appropriate surveying time under condition R over the 10 chapters in sessions 2-11.

Note that apparently the behavior learned under condition R during session one was maintained. Both Ss began session two with higher ratios than those with which they had begun session one. Both Ss made ratios of 1.00 in 5 of the 10 sessions.

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)							
		<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
Condition R	M=	41.66	28.571	0.	25.00	0.	16.666	0.	0.
	S1=	33.333	14.285	0.	0.	0.	0.	0.	0.
	S2=	50.000	42.857	0.	50.000	0.	33.333	0.	0.
Condition NR	M=	41.666	35.714	25.000	10.000	14.285	33.333	9.090	12.500
	S1=	50.000	35.714	25.000	10.000	14.285	16.666	9.090	12.500
	S2=	33.333	35.714	25.000	10.000	14.285	50.000	9.090	12.500
		Chapters (9-15)							
		<u>9</u>	<u>10</u>	<u>11</u>	<u>12</u>	<u>13</u>	<u>14</u>	<u>15</u>	
Condition R	M=	12.500	0.	25.000	49.999	15.625	5.000	0.	
	S1=	0.	0.	0.	81.818	12.500	0.	0.	
	S2=	25.000	0.	50.000	18.181	18.750	10.000	0.	
Condition NR	M=	25.000	16.666	16.666	45.454	40.625	20.000	20.000	
	S1=	25.000	16.666	16.666	45.454	56.250	20.000	30.000	
	S2=	25.000	16.666	16.666	45.454	25.000	20.000	10.000	

TABLE 2A

STATISTICAL COMPARISON OF ACQUISITION OMISSIONS UNDER TWO LEARNING  
CONDITIONS OVER THE 15 CHAPTERS IN SESSION ONE

Single factor ANOVA With Repeated Measures (Winer, 1962)

Research hypothesis.

The mean of the RS1 is smaller than the mean of the NRS1.

Statistical hypotheses.

$$H_0: \overline{RS1} = \overline{NRS1}$$

$$H_1: \overline{RS1} < \overline{NRS1}$$

Findings.

Source	df	Sum of Squares	Mean Square	F
Rows	1	1941.741	1941.741	13.537
Columns	14	7952.159	568.011	
Residual	14	2008.059	143.432	
Total	29	11901.959	F.95 (1,14) = 4.60	

Decisions.

1. Reject the null hypothesis of no significant difference between means.
2. Retain the alternate hypothesis that the mean of the RS1 is smaller than the mean of the NRS1.

TABLE 2B

STATISTICAL COMPARISON OF ACQUISITION OMISSIONS UNDER TWO LEARNING  
CONDITIONS OVER THE 15 CHAPTERS IN SESSION ONE

Single factor ANOVA With Repeated Measures (Winer, 1962)

Research hypothesis.

The mean of the RS1 is smaller than the mean of the NRS2.

Statistical hypotheses.

Ho:  $\overline{RS1} = \overline{NRS2}$

H1:  $\overline{RS1} < \overline{NRS2}$

Findings.

Source	df	Sum of Squares	Mean Square	F
Rows	1	1425.155	1425.155	42.636
Columns	14	6924.171	494.583	
Residual	14	467.966	33.426	
Total	29	8817.292	F.95 (1,14) = 4.60	

Decisions.

1. Reject the null hypothesis of no significant difference between the means.
2. Retain the alternate hypothesis that the mean of RS1 is smaller than the mean of NRS2.

TABLE 2C

STATISTICAL COMPARISON OF ACQUISITION OMISSIONS UNDER TWO LEARNING  
CONDITIONS OVER THE 15 CHAPTERS IN SESSION ONE

Single factor ANOVA With Repeated Measures (Winer, 1962)

Research hypothesis.

The mean of the RS2 is smaller than the mean of the NRS1.

Statistical hypotheses.

$$H_0: \overline{RS2} = \overline{NRS1}$$

$$H_1: \overline{RS2} < \overline{NRS1}$$

Findings.

Source	df	Sum of Squares	Mean Square	F
Rows	1	241.797	241.797	.960
Columns	14	5541.470	395.819	
Residual	14	3526.064	251.861	
Total	29	9309.331	F.95 (1,14) = 4.60	

Decisions.

1. Retain the null hypothesis of no significant difference between means.
2. Reject the alternate hypothesis that the mean of the RS2 is smaller than the mean of the NRS1.

TABLE 2D

STATISTICAL COMPARISON OF ACQUISITION OMISSIONS UNDER TWO LEARNING  
CONDITIONS OVER THE 15 CHAPTERS IN SESSION ONE

Single factor ANOVA With Repeated Measures (Winer, 1962)

Research hypothesis.

The mean of the RS2 is smaller than the NRS2.

Statistical hypotheses.

Ho:  $\overline{RS2} = \overline{NRS2}$

H1:  $\overline{RS2} < \overline{NRS2}$

Findings.

Source	df	Sum of Squares	Mean Square	F
Rows	1	85.301	85.301	.485
Columns	14	5511.591	393.685	
Residual	14	2460.106	175.721	
Total	29	8056.998	F.95 (1,14) = 4.60	

Decisions.

1. Retain the null hypothesis of no significant difference between means.
2. Reject the alternate hypothesis that the mean of the RS2 is smaller than the mean of NRS2.



TABLE 3

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

		Sessions				
		<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>
Condition R	M=	0.	1.190	2.272	1.086	0.
	S1=	0.	0.	0.	0.	0.
	S2=	0.	2.380	4.545	2.173	0.
Condition NR	M=	12.068	17.856	15.908	28.260	18.103
	S1=	5.172	14.285	11.363	23.913	17.241
	S2=	18.965	21.428	20.454	32.608	18.965
		Sessions				
		<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>11</u>
Condition R	M=	0.	1.063	0.	0.	2.272
	S1=	0.	2.127	0.	0.	0.
	S2=	0.	0.	0.	0.	4.545
Condition NR	M=	19.444	19.148	17.499	10.184	14.772
	S1=	16.666	14.893	3.333	1.851	0.
	S2=	22.222	23.404	31.666	18.518	29.545

TABLE 4A

STATISTICAL COMPARISON OF ACQUISITION OMISSIONS UNDER TWO LEARNING  
CONDITIONS OVER THE 10 CHAPTERS IN SESSIONS 2-11

Single factor ANOVA With Repeated Measures (Winer, 1962)

Research hypothesis.

The mean of the RS1 is smaller than the mean of the NRS1.

Statistical hypotheses.

Ho:  $\overline{RS1} = \overline{NRS1}$

H1:  $\overline{RS1} < \overline{NRS1}$

Findings.

Source	df	Sum of Squares	Mean Square	F
Rows	1	568.071	568.071	18.655
Columns	9	337.416	37.490	
Residual	9	274.066	30.451	
Total	19	1179.553	F.95 (1,9) = 5.12	

Decisions.

1. Reject the null hypothesis of no significant difference between means.
2. Retain the alternate hypothesis that the mean of the RS1 is smaller than the mean of the NRS1.

TABLE 4B

STATISTICAL COMPARISON OF ACQUISITION OMISSIONS UNDER TWO LEARNING  
CONDITIONS OVER THE 10 CHAPTERS IN SESSIONS 2-11

Single factor ANOVA With Repeated Measures (Winer, 1962)

Research hypothesis.

The mean of the RS1 is smaller than the mean of the NRS2.

Statistical hypotheses.

Ho:  $\overline{RS1} = \overline{NRS2}$

H1:  $\overline{RS1} < \overline{NRS2}$

Findings.

Source	df	Sum of Squares	Mean Square	F
Rows	1	2776.499	2776.499	183.582
Columns	9	134.525	14.947	
Residual	9	136.122	15.124	
Total	19	3047.146	F.95 (1,9) = 5.12	

Decisions.

1. Reject the null hypothesis of no significant difference between means.
2. Retain the alternate hypothesis that the mean of the RS1 is smaller than the mean of the NRS2.

TABLE 4C

STATISTICAL COMPARISON OF ACQUISITION OMISSIONS UNDER TWO LEARNING  
CONDITIONS OVER THE 10 CHAPTERS IN SESSIONS 2-11

Single factor ANOVA With Repeated Measures (Winer, 1962)

Research hypothesis.

The mean of the RS2 is smaller than the mean of the NRS1.

Statistical hypotheses.

$$H_0: \overline{RS2} = \overline{NRS1}$$

$$H_1: \overline{RS2} < \overline{NRS1}$$

Findings.

Source	df	Sum of Squares	Mean Square	F
Rows	1	526.405	526.405	20.299
Columns	9	286.406	31.822	
Residual	9	233.390	25.932	
Total	19	1046.201	F.95 (1,9) = 5.12	

Decisions.

1. Reject the null hypothesis of no significant difference between means.
2. Retain the alternate hypothesis that the mean of the RS2 is smaller than the mean of the NRS1.

TABLE 4D

STATISTICAL COMPARISON OF ACQUISITION OMISSIONS UNDER TWO LEARNING  
CONDITIONS OVER THE 10 CHAPTERS IN SESSIONS 2-11

Single factor ANOVA With Repeated Measures (Winer, 1962)

Research hypothesis.

The mean of the RS2 is smaller than the mean of the NRS2.

Statistical hypotheses.

Ho:  $\overline{RS2} = \overline{NRS2}$

H1:  $\overline{RS2} < \overline{NRS2}$

Findings.

Source	df	Sum of Squares	Mean Square	F
Rows	1	2511.758	2511.758	180.663
Columns	9	174.533	19.392	
Residual	9	125.128	13.903	
Total	19	2811.419	F.95 (1, 9) = 5.12	

Decisions.

1. Reject the null hypothesis of no significant difference between means.
2. Retain the alternate hypothesis that the mean of the RS2 is smaller than the mean of the NRS2.

TABLE 5

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

		Chapters (1-8)							
		<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
Condition R	M=	41.666	28.571	0.	5.000	0.	0.	0.	6.250
	S1=	50.000	28.571	0.	10.000	0.	0.	0.	12.500
	S2=	33.333	28.571	0.	0.	0.	0.	0.	0.
Condition NR	M=	25.000	7.142	0.	5.000	14.285	8.333	0.	0.
	S1=	0.	14.285	0.	0.	14.285	0.	0.	0.
	S2=	50.000	0.	0.	10.000	14.285	16.666	0.	0.
		Chapters (9-15)							
		<u>9</u>	<u>10</u>	<u>11</u>	<u>12</u>	<u>13</u>	<u>14</u>	<u>15</u>	
Condition R	M=	0.	0.	0.	9.090	6.250	0.	0.	
	S1=	0.	0.	0.	9.090	6.250	0.	0.	
	S2=	0.	0.	0.	9.090	6.250	0.	0.	
Condition NR	M=	0.	0.	0.	0.	0.	0.	0.	
	S1=	0.	0.	0.	0.	0.	0.	0.	
	S2=	0.	0.	0.	0.	0.	0.	0.	

TABLE 6A

STATISTICAL COMPARISON OF ACQUISITION ADDITIONS UNDER TWO LEARNING  
CONDITIONS OVER THE 15 CHAPTERS IN SESSION ONE

Single factor ANOVA With Repeated Measures (Winer, 1962)

Research hypothesis.

The mean of the RS1 is smaller than the mean of the NRS1.

Statistical hypotheses.

Ho:  $\overline{RS1} = \overline{NRS1}$

H1:  $\overline{RS1} < \overline{NRS1}$

Findings.

Source	df	Sum of Squares	Mean Square	F
Rows	1	257.201	257.201	2.598
Columns	14	1758.669	125.619	
Residual	14	1385.845	98.988	
Total	29	3401.715	F.95 (1,14) = 4.60	

Decisions.

1. Retain the null hypothesis of no significant difference between means.
2. Reject the alternate hypothesis that the mean of the RS1 is smaller than the mean of the NRS1.

TABLE 6B

STATISTICAL COMPARISON OF ACQUISITION ADDITIONS UNDER TWO LEARNING  
CONDITIONS OVER THE 15 CHAPTERS IN SESSION ONE

Single factor ANOVA With Repeated Measures (Winer, 1962)

Research hypothesis.

The mean of the RS1 is smaller than the mean of the NRS2.

Statistical hypotheses.

Ho:  $\overline{RS1} = \overline{NRS2}$

H1:  $\overline{RS1} < \overline{NRS2}$

Findings.

Source	df	Sum of Squares	Mean Square	F
Rows	1	21.607	21.607	.394
Columns	14	4554.729	325.337	
Residual	14	766.423	54.744	
Total	29	5342.759	F.95 (1,14) = 4.60	

Decisions.

1. Retain the null hypothesis of no significant difference between means.
2. Reject the alternate hypothesis that the mean of the RS1 is smaller than the mean of the NRS2.



TABLE 6C

STATISTICAL COMPARISON OF ACQUISITION ADDITIONS UNDER TWO LEARNING  
CONDITIONS OVER THE 15 CHAPTERS IN SESSION ONE

Single factor ANOVA With Repeated Measures (Winer, 1962)

Research hypothesis.

The mean of the RS2 is smaller than the mean of the NRS1.

Statistical hypotheses.

Ho:  $\overline{RS2} = \overline{NRS1}$

H1:  $\overline{RS2} < \overline{NRS1}$

Findings.

Source	df	Sum of Squares	Mean Square	F
Rows	1	78.971	78.971	1.491
Columns	14	1263.517	90.251	
Residual	14	741.494	52.963	
Total	29	2083.982	F.95 (1,14) = 4.60	

Decisions.

1. Retain the null hypothesis of no significant difference between means.
2. Reject the alternate hypothesis that the mean of the RS2 is smaller than the mean of the NRS1.

TABLE 6D

STATISTICAL COMPARISON OF ACQUISITION ADDITIONS UNDER TWO LEARNING  
CONDITIONS OVER THE 15 CHAPTERS IN SESSION ONE

Single factor ANOVA With Repeated Measures (Winer, 1962)

Research hypothesis.

The mean of the RS2 is smaller than the mean of the NRS2.

Statistical hypotheses.

Ho:  $\overline{RS2} = \overline{NRS2}$

H1:  $\overline{RS2} < \overline{NRS2}$

Findings.

Source	df	Sum of Squares	Mean Square	F
Rows	1	6.262	6.262	.098
Columns	14	3289.112	234.936	
Residual	14	892.537	63.752	
Total	29	4187.911	F.95 (1,14) = 4.60	

Decisions.

1. Retain the null hypothesis that the mean of the RS2 is smaller than the mean of the NRS2.
2. Reject the alternate hypothesis that the mean of the RS2 is smaller than the mean of the NRS2.

TABLE 7

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

		Sessions				
		<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>
Condition R	M=	16.387	1.190	3.408	1.086	0.
	S1=	5.172	0.	4.545	2.173	0.
	S2=	27.586	2.380	2.272	0.	0.
Condition NR	M=	18.965	38.095	29.545	5.434	17.241
	S1=	0.	0.	0.	0.	0.
	S2=	37.931	76.190	59.090	10.869	34.482
		Sessions				
		<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>11</u>
Condition R	M=	0.	0.	0.	0.	.636
	S1=	0.	0.	0.	0.	0.
	S2=	0.	0.	0.	0.	1.272
Condition NR	M=	3.703	29.787	5.925	15.740	36.363
	S1=	0.	0.	1.851	0.	0.
	S2=	7.407	59.574	10.000	31.481	72.727

TABLE 8A

STATISTICAL COMPARISON OF ACQUISITION ADDITIONS UNDER TWO LEARNING  
CONDITIONS OVER THE 10 CHAPTERS IN SESSIONS 2-11

Single factor ANOVA With Repeated Measures (Winer, 1962)

Research hypothesis.

The mean of the RS1 is smaller than the mean of the NRS1.

Statistical hypotheses.

Ho:  $\overline{RS1} = \overline{NRS1}$

H1:  $\overline{RS1} < \overline{NRS1}$

Findings.

Source	df	Sum of Squares	Mean Square	F
Rows	1	5.039	5.039	1.994
Columns	9	18.335	2.037	
Residual	9	22.739	2.526	
Total	19	46.113	F.95 (1,9) = 5.12	

Decisions.

1. Retain the null hypothesis of no significant difference between means.
2. Reject the alternate hypothesis that the mean of the RS1 is smaller than the mean of the NRS1.

TABLE 8B

STATISTICAL COMPARISON OF ACQUISITION ADDITIONS UNDER TWO LEARNING  
CONDITIONS OVER THE 10 CHAPTERS IN SESSIONS 2-11

Single factor ANOVA With Repeated Measures (Winer, 1962)

Research hypothesis.

The mean of the RS1 is smaller than the mean of the NRS2.

Statistical hypotheses.

Ho:  $\overline{RS1} = \overline{NRS2}$

H1:  $\overline{RS1} < \overline{NRS2}$

Findings.

Source	df	Sum of Squares	Mean Square	F
Rows	1	7521.808	7521.808	22.347
Columns	9	3055.328	339.480	
Residual	9	3029.216	336.579	
Total	19	13606.352	F.95 (1,9) = 5.12	

Decisions.

1. Reject the null hypothesis of no significant difference between means.
2. Retain the alternated hypothesis that the mean of the RS1 is smaller than the mean of the NRS2.

TABLE 8C

STATISTICAL COMPARISON OF ACQUISITION ADDITIONS UNDER TWO LEARNING  
CONDITIONS OVER THE 10 CHAPTERS IN SESSIONS 2-11

Single factor ANOVA With Repeated Measures (Winer, 1962)

Research hypothesis.

The mean of the RS2 is smaller than the mean of the NRS1.

Statistical hypotheses.

Ho:  $\overline{RS2} = \overline{NRS1}$

H1:  $\overline{RS2} < \overline{NRS1}$

Findings.

Source	df	Sum of Squares	Mean Square	F
Rows	1	53.330	53.330	1.424
Columns	9	324.092	36.010	
Residual	9	336.871	37.430	
Total	19	714.293	F.95 (1,9) = 5.12	

Decisions.

1. Retain the null hypothesis of no significant difference between means.
2. Reject the alternate hypothesis that the mean of the RS2 is smaller than the mean of the NRS1.

TABLE 8D

STATISTICAL COMPARISON OF ACQUISITION ADDITIONS UNDER TWO LEARNING  
CONDITIONS OVER THE 10 CHAPTERS IN SESSIONS 2-11

Single factor ANOVA With Repeated Measures (Winer, 1962)

Research hypothesis.

The mean of the RS2 is smaller than the mean of the NRS2.

Statistical hypotheses.

Ho:  $\overline{RS2} = \overline{NRS2}$

H1:  $\overline{RS2} < \overline{NRS2}$

Findings.

Source	df	Sum of Squares	Mean Square	F
Rows	1	6670.050	6670.050	18.732
Columns	9	3499.860	388.873	
Residual	9	3204.573	356.063	
Total	19	13374.483	F.95 (1,9) = 5.12	

Decisions.

1. Reject the null hypothesis of no significant difference between means.
2. Retain the alternate hypothesis that the mean of the RS2 is smaller than the mean of the NRS2.

TABLE 9

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

Chapters (1-8)

	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
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	S1=84.000	S1=100.00	S1=83.333	S1=80.000	S1=58.000	S1=64.029	S1=35.457
	S2=66.675	S2=100.00	S2=90.950	S2=42.316	S2=52.000	S2=58.000	S2=78.314	S2=42.328
Condition NR	M=50.000	M=40.992	M=50.000	M=50.000	M=38.000	M=62.333	M=28.571	M=39.157
	S1=50.000	S1=53.414	S1=50.000	S1=50.000	S1=44.000	S1=58.000	S1=14.285	S1=35.457
	S2=50.000	S2=28.571	S2=50.000	S2=50.000	S2=32.000	S2=66.666	S2=42.857	S2=42.857

Chapters (9-15)

	<u>9</u>	<u>10</u>	<u>11</u>	<u>12</u>	<u>13</u>	<u>14</u>	<u>15</u>
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	S1=66.666	S1=66.666	S1=16.000	S1=60.000	S1=52.000	S1=52.000
	S2=50.000	S2=82.633	S2=91.333	S2=44.000	S2=92.000	S2=92.000	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	S1=66.666	S1=66.666	S1=40.000	S1=40.000	S1=60.000	S1=60.000
	S2=25.000	S2=66.666	S2=66.666	S2=40.000	S2=40.000	S2=52.000	S2=80.000



TABLE 10A

STATISTICAL COMPARISON OF TEST SCORE PERCENTAGES UNDER TWO LEARNING  
CONDITIONS OVER THE 15 CHAPTERS IN SESSION ONE

Single factor ANOVA With Repeated Measures (Winer, 1962)

Research hypothesis.

The mean of the RS1 is larger than the mean of the NRS1.

Statistical hypotheses.

Ho:  $\overline{RS1} = \overline{NRS1}$

H1:  $\overline{RS1} > \overline{NRS1}$

Findings.

Source	df	Sum of Squares	Mean Square	F
Rows	1	2038.194	2038.194	7.405
Columns	14	5982.698	427.335	
Residual	14	3853.251	275.232	
Total	29	11874.143	F.95 (1.14) = 4.60	

Decisions.

1. Reject the null hypothesis of no significant difference between means.
2. Retain the alternate hypothesis that the mean of the RS1 is larger than the mean of the NRS1.

TABLE 10B

STATISTICAL COMPARISON OF TEST SCORE PERCENTAGES UNDER TWO LEARNING  
CONDITIONS OVER THE 15 CHAPTERS IN SESSION ONE

Single factor ANOVA With Repeated Measures (Winer, 1962)

Research hypothesis.

The mean of the RS1 is larger than the mean of the NRS2.

Statistical hypotheses.

Ho:  $\overline{RS1} = \overline{NRS2}$

H1:  $\overline{RS1} > \overline{NRS2}$

Findings.

Source	df	Sum of Squares	Mean Square	F
Rows	1	1711.176	1711.176	4.667
Columns	14	5056.953	361.210	
Residual	14	5132.511	366.607	
Total	29	11900.640	F.95 (1,14) = 4.60	

Decisions.

1. Reject the null hypothesis of no significant difference between means.
2. Retain the alternate hypothesis that the mean of the RS1 is larger than the mean of the NRS2.

TABLE 10C

STATISTICAL COMPARISON OF TEST SCORE PERCENTAGES UNDER TWO LEARNING  
CONDITIONS OVER THE 15 CHAPTERS IN SESSION ONE

Single factor ANOVA With Repeated Measures (Winer, 1962)

Research hypothesis.

The mean of the RS2 is larger than the mean of the NRS1.

Statistical hypotheses.

$$H_0: \overline{RS2} = \overline{NRS1}$$

$$H_1: \overline{RS2} > \overline{NRS1}$$

Findings.

Source	df	Sum of Squares	Mean Square	F
Rows	1	4061.831	4061.831	19.263
Columns	14	6305.659	450.404	
Residual	14	2951.959	210.854	
Total	29	13319.449	F.95 (1,14) = 4.60	

Decisions.

1. Reject the null hypothesis of no significant difference between means.
2. Retain the alternate hypothesis that the mean of the RS2 is larger than the mean of the NRS1.

TABLE 10D

STATISTICAL COMPARISON OF TEST SCORE PERCENTAGES UNDER TWO LEARNING  
CONDITIONS OVER THE 15 CHAPTERS IN SESSION ONE

Single factor ANOVA With Repeated Measures (Winer, 1962)

Research hypothesis.

The mean of the RS2 is larger than the mean of the NRS2.

Statistical hypotheses.

Ho:  $\overline{RS2} = \overline{NRS2}$

H1:  $\overline{RS2} > \overline{NRS2}$

Findings.

Source	df	Sum of Squares	Mean Square	F
Rows	1	3614.251	3614.251	13.622
Columns	14	5881.860	420.132	
Residual	14	3714.290	265.306	
Total	29	13210.401	F.95 (1,14) = 4.60	

Decisions.

1. Reject the null hypothesis of no significant difference between means.
2. Retain the alternate hypothesis that the mean of the RS2 is larger than the mean of the NRS2.

TABLE 11

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

		Sessions				
		<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>
Condition R	M=	54.977	44.238	37.041	66.666	34.545
	S1=	59.864	46.163	50.933	58.333	29.091
	S2=	50.091	42.313	23.150	75.000	40.000
Condition NR	M=	34.563	57.699	5.562	48.216	28.181
	S1=	16.809	79.812	9.266	59.525	40.000
	S2=	52.318	35.587	1.858	36.908	16.363
		Sessions				
		<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>11</u>
Condition R	M=	41.545	25.118	50.589	28.465	61.155
	S1=	56.160	38.436	52.056	16.160	70.000
	S2=	26.930	11.800	49.122	40.770	52.310
Condition NR	M=	17.310	32.454	43.572	27.695	24.235
	S1=	0.000	64.273	42.111	10.770	33.080
	S2=	34.620	.636	45.033	44.620	15.390

TABLE 12A

STATISTICAL COMPARISON OF TEST SCORE PERCENTAGES UNDER TWO LEARNING  
CONDITIONS OVER THE 10 CHAPTERS IN SESSIONS 2-11

Single factor ANOVA With Repeated Measures (Winer, 1962)

Research hypothesis.

The mean of the RS1 is larger than the mean of the NRS1.

Statistical hypotheses.

Ho:  $\overline{RS1} = \overline{NRS1}$

H1:  $\overline{RS1} > \overline{NRS1}$

Findings.

Source	df	Sum of Squares	Mean Square	F
Rows	1	738.720	738.720	1.532
Columns	9	4297.538	477.504	
Residual	9	4338.822	482.091	
Total	19	9375.080	F.95 (1,9) = 5.12	

Decisions.

1. Retain the null hypothesis of no significant difference between means.
2. Reject the alternate hypothesis that the mean of the RS1 is larger than the mean of the NRS1.

TABLE 12B

STATISTICAL COMPARISON OF TEST SCORE PERCENTAGES UNDER TWO LEARNING  
CONDITIONS OVER THE 10 CHAPTERS IN SESSIONS 2-11

Single factor ANOVA With Repeated Measures (Winer, 1962)

Research hypothesis.

The mean of the RS1 is larger than the mean of the NRS2.

Statistical hypotheses.

Ho:  $\overline{RS1} = \overline{NRS2}$

H1:  $\overline{RS1} > \overline{NRS2}$

Findings.

Source	df	Sum of Squares	Mean Square	F
Rows	1	1879.143	1879.143	6.537
Columns	9	2765.395	307.266	
Residual	9	2587.123	287.458	
Total	19	7231.661	F.95 (1,9) = 5.12	

Decisions.

1. Reject the null hypothesis of no significant difference between means.
2. Retain the alternate hypothesis that the mean of the RS1 is larger than the mean of the NRS2.

TABLE 12C

STATISTICAL COMPARISON OF TEST SCORE PERCENTAGES UNDER TWO LEARNING  
CONDITIONS OVER THE 10 CHAPTERS IN SESSIONS 2-11

Single factor ANOVA With Repeated Measures (Winer, 1962)

Research hypothesis.

The mean of the RS2 is larger than the mean of the NRS1.

Statistical hypotheses.

Ho:  $\overline{RS2} = \overline{NRS1}$

H1:  $\overline{RS2} > \overline{NRS1}$

Findings.

Source	df	Sum of Squares	Mean Square	F
Rows	1	155.904	155.904	.377
Columns	9	5436.175	604.019	
Residual	9	3715.939	412.882	
Total	19	9308.018	F.95 (1,9) = 5.12	

Decisions.

1. Retain the null hypothesis of no significant difference between means.
2. Reject the alternate hypothesis that the mean of the RS2 is larger than the mean of the NRS1.



TABLE 12D

STATISTICAL COMPARISON OF TEST SCORE PERCENTAGES UNDER TWO LEARNING  
CONDITIONS OVER THE 10 CHAPTERS IN SESSIONS 2-11

Single factor ANOVA With Repeated Measures (Winer, 1962)

Research hypothesis.

The mean of the RS2 is larger than the mean of the NRS2.

Statistical hypotheses.

$$H_0: \overline{RS2} = \overline{NRS2}$$

$$H_1: \overline{RS2} > \overline{NRS2}$$

Findings.

Source	df	Sum of Squares	Mean Square	F
Rows	1	821.158	821.158	6.034
Columns	9	4643.608	515.956	
Residual	9	1224.664	136.073	
Total	19	6689.430	F.95 (1,9) = 5.12	

Decisions.

1. Reject the null hypothesis of no significant difference between means.
2. Retain the alternate hypothesis that the mean of the RS2 is larger than the mean of the NRS2.

TABLE 13

GROUP AVERAGE AND INDIVIDUAL SURVEYING TIME,  
IN SECONDS, FOR THE 15 CHAPTERS IN SESSION ONE

## Chapters (1-8)

	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
Condition R	M=273.5	M=278	M= 37.5	M=102.5	M= 56	M= 72	M= 67	M= 82.5
	S1=332	S1=170	S1= 38	S1= 78	S1= 52	S1= 79	S1= 67	S1= 86
	S2=215	S2=386	S2= 37	S2=127	S2= 60	S2= 65	S2= 67	S2= 79
Condition NR	M= 64.5	M= 82	M= 14	M= 60.5	M= 49	M= 43.5	M= 50.5	M= 49
	S1= 30	S1= 75	S1= 11	S1= 58	S1= 45	S1= 35	S1= 51	S1= 45
	S2= 99	S2= 89	S2= 17	S2= 63	S2= 53	S2= 52	S2= 50	S2= 53

## Chapters (9-15)

	<u>9</u>	<u>10</u>	<u>11</u>	<u>12</u>	<u>13</u>	<u>14</u>	<u>15</u>
Condition R	M= 60	M= 43	M= 64.5	M=508.5	M=182.5	M=130	M= 75.5
	S1= 46	S1= 48	S1= 36	S1=867	S1=206	S1=104	S1= 79
	S2= 74	S2= 38	S2= 93	S2=150	S2=159	S2=156	S2= 72
Condition NR	M= 23.5	M= 38	M= 39.5	M= 36	M= 65	M= 84	M= 55.5
	S1= 21	S1= 37	S1= 55	S1= 32	S1= 35	S1= 77	S1= 49
	S2= 26	S2= 39	S2= 24	S2= 40	S2= 95	S2= 91	S2= 62

TABLE 14A

STATISTICAL COMPARISON OF SURVEYING TIME,  
IN SECONDS, FOR THE 15 CHAPTERS IN SESSION ONE

Single factor ANOVA With Repeated Measures (Winer, 1962)

Research hypothesis.

The mean of the RS1 is smaller than the mean of the NRS1.

Statistical hypotheses.

$$H_0: \overline{RS1} = \overline{NRS1}$$

$$H_1: \overline{RS1} < \overline{NRS1}$$

Findings.

Source	df	Sum of Squares	Mean Square	F
Rows	1	88780.799	88780.799	3.784
Columns	14	311534.467	22252.461	
Residual	14	328460.201	23461.442	
Total	29	728775.467	F.95 (1,14) = 4.60	

Decisions.

1. Retain the null hypothesis of no significant difference between means.
2. Reject the alternate hypothesis that the mean of the RS1 is smaller than the mean of the NRS1.

TABLE 14B

STATISTICAL COMPARISON OF SURVEYING TIME,  
IN SECONDS, FOR THE 15 CHAPTERS IN SESSION ONE

Single factor ANOVA With Repeated Measures (Winer, 1962)

Research hypothesis.

The mean of the RS1 is smaller than the mean of the NRS2.

Statistical hypotheses.

$$H_0: \overline{RS1} = \overline{NRS2}$$

$$H_1: \overline{RS1} < \overline{NRS2}$$

Findings.

Source	df	Sum of Squares	Mean Square	F
Rows	1	68640.832	68640.832	3.081
Columns	14	333363.800	23811.700	
Residual	14	311837.668	22274.119	
Total	29	713842.300	F.95 (1,14) = 4.60	

Decisions.

1. Retain the null hypothesis of no significant difference between means.
2. Reject the alternate hypothesis that the mean of the RS1 is smaller than the mean of the NRS2.

TABLE 14C

STATISTICAL COMPARISON OF SURVEYING TIME,  
IN SECONDS, FOR THE 15 CHAPTERS IN SESSION ONE

Single factor ANOVA With Repeated Measures (Winer, 1962)

Research hypothesis.

The mean of the RS2 is smaller than the mean of the NRS1.

Statistical hypotheses.

$$H_0: \overline{RS2} = \overline{NRS1}$$

$$H_1: \overline{RS2} < \overline{NRS1}$$

$$H_2: \overline{RS2} > \overline{NRS1}$$

Findings.

Source	df	Sum of Squares	Mean Square	F
Rows	1	41962.799	41962.799	12.326
Columns	14	70343.467	5024.533	
Residual	14	47659.201	3404.228	
Total	29	159965.467	F.95 (1,14) = 4.60	

Decisions.

1. Reject the null hypothesis of no significant difference between means.
2. Reject the alternate hypothesis that the mean of the RS2 is smaller than the mean of the NRS1.
3. Retain the alternate hypothesis that the mean of RS2 is larger than the mean of NRS1.

TABLE 14D

STATISTICAL COMPARISON OF SURVEYING TIME,  
IN SECONDS, FOR THE 15 CHAPTERS IN SESSION ONE

Single factor ANOVA With Repeated Measures (Winer, 1962)

Research hypothesis.

The mean of the RS2 is smaller than the mean of the NRS2.

Statistical hypotheses.

Ho:  $\overline{RS2} = \overline{NRS2}$

H1:  $\overline{RS2} < \overline{NRS2}$

H2:  $\overline{RS2} > \overline{NRS2}$

Findings.

Source	df	Sum of Squares	Mean Square	F
Rows	1	28520.832	28520.832	10.252
Columns	14	84264.300	6018.878	
Residual	14	38945.168	2781.797	
Total	29	151730.300	F.95 (1,14) = 4.60	

Decisions.

1. Reject the null hypothesis of no significant difference between means.
2. Reject the alternate hypothesis that the mean of the RS2 is smaller than the mean of the NRS2.
3. Retain the alternate hypothesis that the mean of RS2 is larger than the mean of NRS2.

TABLE 15

GROUP AVERAGE AND INDIVIDUAL SURVEYING TIME,  
IN SECONDS, FOR THE 10 CHAPTERS IN SESSIONS 2-11

		Sessions				
		<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>
Condition R	M=847	M=420.5	M=527.5	M=453.5	M=480	
	S1=795	S1=421	S1=537	S1=409	S1=510	
	S2=899	S2=420	S2=518	S2=498	S2=450	
Condition NR	M=478	M=522	M=423	M=265	M=458.5	
	S1=425	S1=431	S1=323	S1=275	S1=422	
	S2=531	S2=613	S2=523	S2=255	S2=495	
		Sessions				
		<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>11</u>
Condition R	M=652	M=391.5	M=551	M=451	M=513.5	
	S1=607	S1=410	S1=522	S1=430	S1=430	
	S2=697	S2=373	S2=580	S2=472	S2=597	
Condition NR	M=430	M=332	M=430.5	M=402	M=483	
	S1=500	S1=307	S1=466	S1=425	S1=435	
	S2=360	S2=357	S2=395	S2=379	S2=531	

TABLE 16A

STATISTICAL COMPARISON OF SURVEYING TIME,  
IN SECONDS, FOR THE 10 CHAPTERS IN SESSIONS 2-11

Single factor ANOVA With Repeated Measures (Winer, 1962)

Research hypothesis.

The mean of the RS1 is smaller than the mean of the NRS1.

Statistical hypotheses.

Ho:  $\overline{RS1} = \overline{NRS1}$

H1:  $\overline{RS1} < \overline{NRS1}$

H2:  $\overline{RS1} > \overline{NRS1}$

Findings.

Source	df	Sum of Squares	Mean Square	F
Rows	1	56392.2	56392.200	8.392
Columns	9	120338.0	13370.888	
Residual	9	60477.8	6719.755	
Total	19	237208.0	F.95 (1,9) = 5.12	

Decisions.

1. Reject the null hypothesis of no significant difference between means.
2. Reject the alternate hypothesis that the mean of the RS1 is smaller than the mean of the NRS1.
3. Retain the alternate hypothesis that the mean of the RS1 is larger than the mean of the NRS1.



TABLE 16B

STATISTICAL COMPARISON OF SURVEYING TIME,  
IN SECONDS, FOR THE 10 CHAPTERS IN SESSIONS 2-11

Single factor ANOVA With Repeated Measures (Winer, 1962)

Research hypothesis.

The mean of the RS1 is smaller than the mean of the NRS2.

Statistical hypotheses.

Ho:  $\overline{RS1} = \overline{NRS2}$

H1:  $\overline{RS1} < \overline{NRS2}$

Findings.

Source	df	Sum of Squares	Mean Square	F
Rows	1	19971.2	19971.200	1.958
Columns	9	150106.0	16678.444	
Residual	9	91751.8	10194.644	
Total	19	261829.0	F.95 (1,9) = 5.12	

Decisions.

1. Retain the null hypothesis of no significant difference between means.
2. Reject the alternate hypothesis that the mean of the RS1 is smaller than the mean of the NRS2.

TABLE 16C

STATISTICAL COMPARISON OF SURVEYING TIME,  
IN SECONDS, FOR THE 10 CHAPTERS IN SESSIONS 2-11

Single factor ANOVA With Repeated Measures (Winer, 1962)

Research hypothesis.

The mean of the RS2 is smaller than the mean of the NRS1.

Statistical hypotheses.

Ho:  $\overline{RS2} = \overline{NRS1}$       H1:  $\overline{RS2} < \overline{NRS1}$       H2:  $\overline{RS2} > \overline{NRS1}$

Findings.

Source	df	Sum of Squares	Mean Square	F
Rows	1	111751.25	111751.250	11.53
Columns	9	175806.05	19534.005	
Residual	9	87223.25	9691.472	
Total	19	374780.55	F.95 (1,9) = 5.12	

Decisions.

1. Reject the null hypothesis of no significant difference between means.
2. Reject the alternate hypothesis that the mean of the RS2 is smaller than the NRS1.
3. Retain the alternate hypothesis that the mean of the RS2 is larger than the mean of the NRS1.

TABLE 16D

STATISTICAL COMPARISON OF SURVEYING TIME,  
IN SECONDS, FOR THE 10 CHAPTERS IN SESSIONS 2-11

Single factor ANOVA With Repeated Measures (Winer, 1962)

Research hypothesis.

The mean of the RS2 is smaller than the mean of the NRS2.

Statistical hypotheses.

$$H_0: \overline{RS2} = \overline{NRS2}$$

$$H_1: \overline{RS2} < \overline{NRS2}$$

Findings.

Source	df	Sum of Squares	Mean Square	F
Rows	1	56711.25	56711.250	3.627
Columns	9	183369.05	20374.338	
Residual	9	140702.25	15633.583	
Total	19	370782.55	F.95 (1,9) = 5.12	

Decisions.

1. Retain the null hypothesis of no significant difference between means.
2. Reject the alternate hypothesis that the mean of the RS2 is smaller than the mean of the NRS2.

TABLE 17

## SUMMARY OF STATISTICAL COMPARISONS

CRITERIA	COMPARISONS							
	A		B		C		D	
	RS1	NRS1	RS1	NRS2	RS2	NRS1	RS2	NRS2
<u>I. Survey Omissions</u>								
Session One (TABLES 2A-2D)	*		*		ns		ns	
Sessions 2-11 (TABLES 4A-4D)	*		*		*		*	
<u>II. Survey Additions</u>								
Session One (TABLES 6A-6D)	ns		ns		ns		ns	
Sessions 2-11 (TABLES 8A-8D)	ns		*		ns		*	
<u>III. Test Scores</u>								
Session One (TABLES 10A-10D)	*		*		*		*	
Sessions 2-11 (TABLES 12A-12D)	ns		*		ns		*	
<u>IV. Surveying Time</u>								
Session One (TABLES 14A-14D)	ns		ns		*		*	
Sessions 2-11 (TABLES 16A-16D)	*		ns		*		ns	

\* = Significant at the .05 level of confidence

ns = Not significantly different

TABLE 18  
 INDIVIDUAL RATIOS OF APPROPRIATE SURVEYING TIME  
 TO TOTAL SURVEYING TIME UNDER CONDITION R  
 OVER THE 15 CHAPTERS IN SESSION ONE

Chapters (1-5)				
<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
S1= .487	S1= .794	S1=1.000	S1= .897	S1=1.000
S2= .637	S2= .629	S2=1.000	S2= .771	S2=1.000
Chapters (6-10)				
<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>
S1=1.000	S1=1.000	S1= .953	S1=1.000	S1=1.000
S2= .938	S2=1.000	S2=1.000	S2= .878	S2=1.000
Chapters (11-15)				
<u>11</u>	<u>12</u>	<u>13</u>	<u>14</u>	<u>15</u>
S1=1.000	S1= .456	S1= .907	S1=1.000	S1=1.000
S2= .817	S2= .880	S2= .830	S2= .670	S2=1.000

TABLE 19  
 INDIVIDUAL RATIOS OF APPROPRIATE SURVEYING TIME  
 TO TOTAL SURVEYING TIME UNDER CONDITION R  
 OVER THE 10 CHAPTERS IN SESSIONS 2-11

Sessions (2-6)				
<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>
S1= .898	S1=1.000	S1= .931	S1= .606	S1=1.000
S2= .784	S2= .969	S2= .947	S2= .873	S2=1.000
Sessions (7-11)				
<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>11</u>
S1=1.000	S1= .992	S1=1.000	S1= .976	S1=1.000
S2=1.000	S2=1.000	S2=1.000	S2=1.000	S2= .948

## CHAPTER IV

### DISCUSSION

The purpose of this experiment was to examine the effects of reinforcement upon the acquisition of surveying behavior following a lecture (with modeling) on the subject. A comparison was made between Ss who were reinforced for emitting the behaviors described in the lecture, and Ss who were not reinforced for appropriate behavior.

The study was not primarily designed to examine whether reinforcement was efficacious in conditioning appropriate survey behavior, but whether reinforcement after a lecture on surveying, and modeling such behavior, was more efficacious than the lecture and modeling only. Of course, as comparisons were made, both factors were investigated.

The experiment was designed to utilize a typical study setting and to bring the R Ss under stimulus control of a study light. This was done to begin development of appropriate study after the experiment was over. To make the experiment more useful for typical college situations, Ss were chosen to represent difficult cases, that is to say, they were marginally motivated, academically deficient, and void of good study behavior.

A pre-experimental assumption was made that even weak students could be conditioned to emit basic proper study habits, and that these may lead to more complex habits later. It was assumed further that students must learn some successive approximation of the final behavior desired if they are void in that behavior at the outset. To emit all the

behavior included in the SQ3R, for example, would require a tremendously complex chained performance. This experiment was only a beginning to that process.

The experiment was designed further to develop a procedure whereby an intensive study of Ss could be made. The utilization of objective records such as the video tape recordings were extremely helpful in this study. Any questionable situations of the Ss' verbal response could be clarified with a playback. The use of a light on a clock was a remarkably accurate indication of appropriate surveying behavior and the timing of such behavior. This experiment was unique in its use of physical apparatus for intensive study of survey behavior. It apparently avoided many of the limitations and shortcomings of some other studies in human verbal responses.

The employment of student Es demonstrated that minimally trained non-professionals can serve as reliable supervisors of such a technical operation, freeing the principal investigator for other supervisory functions. The Es not only were capable of accurate supervision, but learned more than anticipated about the principles of operant behavior. It occurred to the principal investigator that this might be an excellent teaching method for students in that subject area. The Es became interested in the outcome of the experiment, and developed a greater interest in experimental psychology. The female E transferred to a four-year college as a psychology major in the quarter following the experiment.



## Behavior Change

The effect of the lecture on surveying behavior, including modeling of that behavior was somewhat surprising. All Ss were void in surveying behavior (as measured by the baseline session which was videotaped) before the experiment began. By contrast, the Ss who were not reinforced, later were emitting much appropriate behavior described in the lecture. It may be concluded, therefore, that the lecture was effective to that extent. In the instances where R behavior was significantly better than NR behavior, it is notable that the differences appeared even greater when it was realized that the Ss under both learning conditions had progressed so far in numbers of desirable survey behaviors emitted, when compared to their baseline voids.

When acquisition additions were compared, for example, it is important to note that the non-significant results on the four comparisons in session one are not because Ss under both learning conditions made equally great numbers of additions, but that they all made equally few additions. The acquisition addition percentages for all four Ss over all 15 chapters are amazingly low: 44 of the 60 observations were 0; and only five scores exceeded 17% error.

Of the four comparisons in sessions 2-11 acquisition addition percentages of 0 accounted for 22 of the 40 observations. Significant differences were shown when RS1 and RS2 were compared with NRS2 whose error percentage ranged from 7 to 76.

It appears that the lecture with modeling may be an effective way to develop survey behavior when intensive study or immediate reinforcement may not be possible. It is feasible that the success of the NR Ss (relative to their baseline scores) may be attributed to the "Hawthorne Effect," in that they were reinforced for coming to the experimental room to survey. They knew someone was watching them and listening to them. NRS2 said once that he sure was "glad to be a TV star."

#### Acquisition Omissions

That R Ss made significantly fewer acquisition omissions on two of the 4 comparisons in session one, and on all 4 comparisons in sessions 2-11 is evidence that learning condition R was effective in producing appropriate surveying behavior. All appropriate topic sentences were read by both R Ss, and they did it with fewer errors than did the NR Ss.

It bears repeating at this point that where non-significant differences were found (session one: C and D) it was not because the R S and the NR Ss made equally large omission error percentages, but that all Ss did about equally well. Of the 45 observations in question only 3 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 RS1 was significantly better when compared to NR Ss than was that of RS2. It was not readily apparent why RS2

occasionally (namely, on 3 of the 15 chapters) made several omissions, thus raising his error percentage to a level similar to that of the NR Ss. Perhaps RS2 caught-on more slowly than RS1, since during sessions 2-11 his performance on this criterion was significantly better than the NR Ss.

#### Acquisition Additions

It was noted above that the errors of surveying addition were minimal for all Ss, reducing the variability between learning conditions and within the performances of individual S. Therefore the difference, statistically, was non-significant. It seems explainable further that the natural error in surveying would more likely be one of omission rather than addition. For marginally motivated students (for whom studying was laborious), the most easily remembered direction from the lecture on surveying might have been one asking them not to read more than was required.

It bears mentioning further, that the 15 chapters in session one had varying numbers of distracters in terms of bold-faced headings. In almost all chapters there were few plausible sentences or distracters that might have been considered appropriate by the Ss. This probably reduced the number of surveying addition errors, thereby reducing the variability between Ss. However, in sessions 2-11 in which the chapters surveyed had several distracters, the probabilities for error increased. In sessions 2-11, with greater opportunity for error, 2 of the 4 comparisons were significantly different, showing the effectiveness of learning condition R.

## Test Scores

It was observed that in 6 of the 8 comparisons significant differences occurred. Learning condition R, as measured by the test scores, seemed to be effective. It is interesting to note one apparent relationship between surveying behavior and test scores. The only two comparisons (A and C) in which non-significant findings were shown, were characterized consistently in the following ways: (1) NRS1 made significantly more surveying omissions; (2) made a similar number of acquisition additions; and (3) took significantly less time to survey, than did RS1 (comparison A) and RS2 (comparison C). The significant findings for test score comparisons (B and D) in sessions 2-11, however, were associated with (1) significant differences in survey omissions; (2) significantly fewer acquisition additions; and (3) non-significant differences in surveying time.

The consistent variables are surveying time and additions. When test scores were significantly better, there were significantly fewer additions and non-significant time differences. When the test scores were not significantly different, there were non-significant differences in acquisition additions and significant differences in surveying time.

In short, when R Ss read as much inappropriate material as did the NR Ss, and took significantly longer to do so; although they omitted significantly less appropriate material, their test scores were not really better.

It may be that the differences were the results of the additions or the time. Perhaps the explanation is more readily available in the

difference between the NR Ss. In sessions 2-11 NRS1 did well enough on the tests to minimize the variance between her performance and that of either of the R Ss with whom she was compared; whereas NRS2 did not do that well.

Since both non-significant test score percentages occurred in sessions 2-11, it was considered that the 24 hour delay between surveying and testing may have been the cause. However, two of the four comparisons in sessions 2-11 showed significantly better test score percentages by RS1 and RS2 than by NRS2. Therefore, it cannot be posited with any certainty whether it was the personal differences between NRS1 and NRS2 or the time delay between surveying and testing.

It seems evident from the data gathered that the more sophisticated content, taken after at least 24 hours, was more difficult for both groups, but perhaps more so for the R group.

During sessions 2-11 it came to the attention of the principal investigator that at different times both the R Ss had had debilitating personal problems. It was felt that those problems may have affected the concentration of the R Ss in the sessions during those times of pressure. Hopefully that did not alter seriously the results of the sessions. Probably those situations were fairly typical of students with serious study problems, and therefore aided, indirectly, the realism of the experiment. However, these considerations may explain the only two non-significant test score comparisons.

It appeared to the principal investigator and the student Es that one of the reasons the R Ss stuck it out with the experiment was because

they had given their word, and knew that the success of the experiment depended upon completion of all that had been explained. This behavior did not appear to be a typical reaction, but was important.

It may be stated that the kind of learning to be derived from surveying was tested rigorously by the 24-hour delay (during sessions 2-11) before examination took place. Surveying behavior does not require that Ss 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 purposive reading. Examining the Ss after 24 hours over material they only saw for a few seconds was asking for an unusual performance, yet amazingly, the performance of the R Ss was evidence of the effect of learning condition R.

It is not known what effect, if any, was caused by not revealing to the Ss how well they did on each test they took. Part of the experimental design was to tell the Ss nothing about their success. The R Ss were given to understand that the presence of the light indicated appropriate surveying behavior. An interesting question would be what would be the effects of reporting the test results to the Ss at each session? In that success on the tests taken should be a conditioned reinforcer, it might have aided both groups equally well.

#### Anecdotal Observations

It was mentioned previously that the female E transferred to a four-year college to pursue a major in psychology, partly due to the

involvement in the experiment. The Ss seemed interested in the outcome of the experiment, and asked about the progress of it. The academic performances of the Ss in their courses at the college were noted after the quarter during which the experiment was conducted. Three of the four Ss dropped slightly in their G.P.A. for the Fall quarter. RS1 went from 1.24 to 1.00, RS2 from .63 to .17, and NRS1 from 1.23 to 1.18. NRS2's G.P.A. went up from 1.78 to 1.92. There were no apparent effects on their G.P.A.'s from the experiment. It should be pointed out, however, that the personal problems during the quarter experienced by the two R Ss did pre-occupy both of them to the point of distraction from their academic coursework.

#### Implications for Further Study

The results of the experiment were considered fairly successful. Approximately 44% (14/32) of the hypotheses were significant in the predicted direction. It is of note, however, that 75% (12/16) of the hypotheses concerning surveying omissions and tests scores were significant. These two criteria are most important in terms of academic relevance, since material to be studied for college classes must not be omitted, and grades most often are based on test scores. The specific aims were reached to a great extent. It was generalized to these four Ss that reinforcement, following a lecture and modeling on survey behavior, is more effective than a lecture and modeling with no reinforcement. It was apparent that surveying behavior was under stimulus control of the study light at the study desk. The experiment was accomplished at minimal professional expense while allowing for intensive study of the Ss involved.

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.

It would appear that the variability between Ss, though they basically are similar in performance, indicates the need for intensive study of greater numbers of Ss, 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 NR Ss had been reinforced after a period of time and the performance of the R Ss which previously brought reinforcement no longer was reinforced, (i.e., was extinguished). What might have occurred can now 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. The objective measures were such that it would not have been unreasonable to record more students and perhaps more sessions.

One of the most interesting ideas that occurred was that of the presence of the Es in the study room. Perhaps the presence of the E where the R Ss could see him might serve as an added social reinforcement, a conditioned reinforcer. It might be feasible to have a large group of students (attempting to learn appropriate study behavior) shaping and reinforcing each other's behavior in a classroom setting.



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## APPENDIX A. Samples of Tests from Session One

## TEST 1

Directions: The selection you have surveyed contains many ideas. Place a check in the blank in front of each idea contained in the material you were directed to survey.

- \_\_\_\_\_ A. In the definitions in most dictionaries, the information about the etymology of a word is enclosed in parentheses.
- \_\_\_\_\_ B. Cognates are words from different languages that have similarities suggesting a common origin.
- \_\_\_\_\_ C. The reader is led from word origins to a history of the development of the English language.
- \_\_\_\_\_ D. English is descended primarily from three Indo-European language groups: Hellenic, Italic, and Germanic.
- \_\_\_\_\_ E. The modern Romance languages are French, Italian, and German.
- \_\_\_\_\_ F. The origin of the word - also called derivation or etymology - is shown in brackets.
- \_\_\_\_\_ G. The English language is a direct descendant of the West Germanic language.
- \_\_\_\_\_ H. The Middle English or transitional period in the development of Modern English lasted from A.D. 1100 to the Norman Conquest.
- \_\_\_\_\_ I. The main theme of the section is effective composition.
- \_\_\_\_\_ J. It was only toward the end of the fifteenth century that English became the common language of all classes of people in England.
- \_\_\_\_\_ K. The Canterbury Tales, by Geoffrey Chaucer, were written in Middle English.
- \_\_\_\_\_ L. An example of etymology includes the prefix, combining form, and suffix.
- \_\_\_\_\_ M. It is very difficult for a modern Englishman to read the original Morte d' Arthur, which was written by Malory nearly five hundred years ago.
- \_\_\_\_\_ N. If each word in the English language were counted every time it is used, it would be apparent that Anglo-Saxon words constitute 40 to 50 percent of the spoken and written language.

## TEST 15

Directions: The selection you have surveyed contains many ideas. Place a check in the blank in front of each idea contained in the material you were directed to survey.

- \_\_\_\_\_ A. "Health Education" discusses the choice of a physician and describes the family physician, specialists, and clinics.
- \_\_\_\_\_ B. The Hippocratic oath, a statement of ethical principles for physicians, dates from the fourth century A.D.
- \_\_\_\_\_ C. The Declaration of Geneva is a modern reformulation of the Hippocratic oath.
- \_\_\_\_\_ D. The standards of training for physicians and the ideals of service set up by the medical profession are the very highest.
- \_\_\_\_\_ E. A county medical society may refuse membership to a physician even if he is licensed to practice in the state.
- \_\_\_\_\_ F. The size of a physician's practice is almost always a clue to his medical ability.
- \_\_\_\_\_ G. The old-time general practitioner, who diagnosed all the family ills, brought the children into the world, etc., belongs to a past generation.
- \_\_\_\_\_ H. In this age of specialization, the family physician is an institution of the past.
- \_\_\_\_\_ I. Internists are physicians who treat internal disorders through either internal surgery or internal radiation.
- \_\_\_\_\_ J. The state licensing board sets up specific requirements for the practice of surgery, obstetrics, pediatrics, and gynecology.
- \_\_\_\_\_ K. Specialization has been developed in medicine in response to needs.
- \_\_\_\_\_ L. Patients often consult specialists about illnesses that could be treated just as effectively by their family physicians.
- \_\_\_\_\_ M. Physicians in various parts of the country are grouping themselves together into clinics in order to practice medicine on a cooperative basis.

- \_\_\_\_\_ N. In general, a patient pays much more for treatment by a very competent surgeon than for treatment by a mediocre surgeon.
- \_\_\_\_\_ O. It is estimated that a family physician can provide nearly 80 percent of all medical services that a family may require.

## APPENDIX B. Samples of Tests from Sessions 2-11

## TEST 1

Directions: The selection you have surveyed contains many ideas. Place a check in the blank in front of each idea contained in the material you were directed to survey.

- \_\_\_\_\_ A. The "behaving organism" is one of the topics to be covered in the book.
- \_\_\_\_\_ B. Psychology is like other sciences in that it seeks to comprehend, to predict, and to control.
- \_\_\_\_\_ C. Man has always sought to understand himself and the world around him, partly because he can reflect upon the past.
- \_\_\_\_\_ D. As defined in the text, psychology includes the study of directly observable behavior, inferred conscious processes, and inferred unconscious processes.
- \_\_\_\_\_ E. Psychology is defined in the text as the science that studies the behavior of man and other animals.
- \_\_\_\_\_ F. Existential and phenomenologically oriented psychologists have had their greatest influence upon clinical psychology.
- \_\_\_\_\_ G. The critical discussion of human and animal behavior points out disagreement over emphasis to be placed upon lower organisms and man in a science of psychology.
- \_\_\_\_\_ H. Unconscious processes are like conscious processes in that both have to be inferred.
- \_\_\_\_\_ I. Psychological science aims to discover new and useful information in the form of verifiable data obtained under conditions such that other qualified people can make similar observations and obtain the same results.
- \_\_\_\_\_ J. In psychology, the distinction between the experimental method and other methods lies chiefly in the degree to which variables are controlled.
- \_\_\_\_\_ K. The term "experimental psychology" once was chiefly applied to sensory processes, perception and learning - subject matter inherited from the earliest 19th century laboratories.
- \_\_\_\_\_ L. Ideally, scientific findings should be verifiable by others.
- \_\_\_\_\_ M. An effective research device is the interview. It is a means of obtaining the data that go into the case history, a means of showing interest in the individual.
- \_\_\_\_\_ N. The variable that changes as a result of change in the antecedent condition is called the dependent variable.



- \_\_\_\_\_ O. Modern psychology may be traced in two early approaches; in Wundt's laboratory, as well as in other roots.
- \_\_\_\_\_ P. In a psychological experiment, the experimenter controls the value of the independent variable.
- \_\_\_\_\_ Q. The role of theory in psychology discusses behaviorism; S-R; Gestalt; cognitive theories; psychoanalysis; and scientific models.
- \_\_\_\_\_ R. A professor randomly divides his psychology class of 300 students into three groups to study the effect of using workbooks upon the level of academic achievement. Group A is taught without workbooks. Group B uses the workbooks occasionally with the teacher's direction. Group C is taught with heavy dependence on the workbooks. The dependent variable is the level of academic achievement.
- \_\_\_\_\_ S. Experimental design and the use and interpretation of correlation coefficients show the importance of measurement in psychology.
- \_\_\_\_\_ T. A variable is something that can occur with different values.
- \_\_\_\_\_ U. An instrument of research which has an important place in contemporary psychology is "the test."
- \_\_\_\_\_ V. A probation officer randomly selected 50 case histories of juvenile delinquents and found that in 42 of the 50 cases there was clear-cut evidence of parental rejection. He concluded that about 80 percent of the time parental rejection is the cause of juvenile delinquency. His conclusion cannot be accepted until he establishes that less parental rejection occurred in a control group of non-delinquents.
- \_\_\_\_\_ W. The value of naturalistic observation is limited by the fact that the observer may substitute anecdotes and interpretation for genuine observations and description.
- \_\_\_\_\_ X. Much of modern learning theory derives from association psychology.
- \_\_\_\_\_ Y. Were you a disciple at the first psychological laboratory in 1879 in Leipzig, you'd probably have studied behavior using the introspective method.
- \_\_\_\_\_ Z. John B. Watson advocated a system known as behaviorism.
- \_\_\_\_\_ AA. When a rat runs a maze you can take a motion picture of its movement, and any competent person can check your statement about the order in which it entered the blind alleys. Most sympathetic to such an approach in studying behavior would be orthodox behaviorists.

- \_\_\_\_\_ BB. Present-day stimulus-response psychologists go beyond the earliest behaviorists in that they are interested in intervening variables.
- \_\_\_\_\_ CC. The type of S-R psychology prevalent in America today employs a broad definition of the concepts of stimulus and response.
- \_\_\_\_\_ DD. Gestalt psychologists hold that our experiences depend upon their patterning, relationships, and organization.
- \_\_\_\_\_ EE. A cognitive theorist would probably maintain that a rat learning the correct pathway from the start of a maze to food in the goal box learns a map or pattern that tells him the location of the goal.
- \_\_\_\_\_ FF. When large masses of data are available, the best method for discovering whether a relationship exists between two variables is correlation.

TEST 10

Directions: The selection you have surveyed contains many ideas. Place a check in the blank in front of each idea contained in the material you were directed to survey.

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- A. On the issue of the relationship of mind to body, the authors seem to favor the position that any phenomenon can be described either in terms of mind or of body.
- B. At one time psychology was thought to be the study of consciousness, and consciousness was accepted as open to immediate observation: now we wonder about its place in a scientific psychology.
- C. An example of an unconscious mental state is not dreams, intoxication, or delirium.
- D. Researchers have found that under ordinary circumstances, most people can only attend clearly to one conversation at a time.
- E. The normal waking consciousness, in which we can report accurately what is happening in the environment about us, is not the only state of awareness.
- F. The state of peak experiences of altered awareness does not imply derangement.
- G. In Stage 1 of sleep dreams most commonly occur.
- H. Rapid eye movement (REM) sleep usually makes arousal of the sleeper difficult.
- I. The most obvious change in states of awareness is that between waking and sleeping, for most of us experience the transition at least twice a day.
- J. The amount of REM sleep decreases with age.
- K. Judges were better than 90 percent successful in determining which dreams had in fact been produced under REM conditions. Therefore, it could be said that dreams under REM conditions are more dreamlike than under NREM conditions and Stage 1-REM is a satisfactory indicator that a subject is dreaming.
- L. REM sleep is most prevalent in premature infants.
- M. The statement that dreams of sleepwalkers closely resemble the activities the person engaged in while sleepwalking is not correct.
- N. Most human dreaming occurs in EEG-Stage 1-REM sleep, although there are three states of the organism: wakefulness, NREM sleep, and REM sleep.

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at 10
- O. According to Freud, dreams utilize symbols to express otherwise unacceptable desires.
- P. Freud announced his influential theory of dreams in his most important book, The Interpretation of Dreams.
- Q. Ted reported a dream in which he was flying over the tallest buildings of a city. The story of his dream is the manifest content of the dream.
- R. According to Freud, the main mechanisms of a dream do not include repression.
- S. If a person is deprived of dreams by being wakened when he begins to dream, what are the consequences? He makes up for it by dreaming more on the following nights.
- T. The hypnotic state or trance recognized today is essentially as it was described in the nineteenth-century heyday of hypnosis.
- U. A decrease in selectivity of attention is not characteristic of the hypnotic state.
- V. According to recent studies, the hypnotizable person is one who welcomes the opportunity to become hypnotized, doesn't appear to be a weak or dependent person, and is usually normal and outgoing with no evidence of neurotic tendencies.
- W. Sarbin's interpretation of hypnosis is that of role-enactment.
- X. Because man can think and dream, he can transcend the mundane everyday world and contemplate visions of unthought-of-worlds.
- Y. The term psychotomimetic refers to drugs that appear to mimic psychosis in a normal individual.
- Z. What happens when a person takes LSD, mescaline, or psilocybin depends partly upon the person's preparation, expectancies, and "set," for the drug state appears to be a highly suggestible one.
- AA. The major uses of the consciousness-, mind-expanding drugs are for pleasure, "thrills" or "kicks," for mental or emotional disturbances, and for philosophical, religious, or social benefits.
- BB. One of the more promising uses of LSD appears to be in the treatment of alcoholism.
- CC. The psychedelic drugs (LSD, mescaline, etc.) lead to a state of suggestibility much like hypnosis.
- DD. Drugs have been used from ancient times to poison or to cure, to relieve pain, to produce sleep or hallucinations.

EE. Not all experiences of LSD are pleasant ones. Responsiveness to a set of suggestions is usually increased with LSD. LSD users tend to give overly positive self-descriptions.

FF. Scher, suggested for further reading, wrote on the nature of mind and its place in the world of science.

## APPENDIX C. Typescript of Pre-experimental Lecture

"The nature of this talk is "How to survey." The word survey comes from Francis Robinson's technique of how to study called Survey Q 3R. Survey stands primarily for what we would call scanning: Looking ahead through the chapter to see what's in it; not reading every word in the chapter, looking only at the major outline of the chapter. I would like to describe in the next few minutes how to survey. Later, you will be asked to survey several work units in this same room I am now sitting in. You will be asked to read the work units in the manner I will describe and in no other way. You must follow as strictly as you can the techniques that I will teach you. Later I will demonstrate how to do it as I expect you to do it. You will be filmed. You will be recorded. We will measure how you do your surveying behavior as it compares to the way I will teach you to do it. If you follow in all respects the instructions I give you, you will do it exactly right.

In surveying, the important thing to do is to read all bold-faced headings. You are to read only the materials that are listed in bold type or have set themselves off as being a major point. The author usually does this by using darker ink, capitalizing the words, or some other technique to set off this material from the other text material. To help you understand exactly what I mean, I will read a chapter the way that I expect you to do it in surveying and you may look at the same chapter and see how I am doing it. I am using for this study a book called Guidance Testing. I will be looking at Chapter 2. You will observe that as I survey this chapter I will be reading aloud. It is absolutely

imperative that you read out loud exactly the material that you are told to read and no other. If you do not read it aloud or if you do not read exactly what you are instructed to read, this will show up in the experiment that you are doing it incorrectly."

[Experimenter began to read aloud the title and number of the chapter, the bold-faced headings and the first sentence under each heading. Then he closed the book and continued lecturing].

"You will not be asked to read aloud any figures, charts, graphs or maps. If the word "example" appears in the text as a heading, you will be asked to read the word "example" and read the first sentence that follows under it. You are not to read tables, charts, graphs, or maps. You are to read the chapter name, the number of the chapter, the bold-faced headings, and the first sentence that follows under any sub-heading.

You will observe from the way that I read this chapter that I did some things consistently and did not do many other things that I could have done. The key things in surveying properly are to read the chapter title, the number of the chapter, the first sentence after the chapter title, if there is one, then the first bold-faced heading, the first sentence under that bold-faced heading and continue in that order through the entire work unit. If there is no sentence under a chapter title or a heading but rather another heading, then you would read both headings in order and then read the first sentence whenever it does occur under the heading.

If you are confused about this you may refer to the way I did it as I read through Chapter 2. [The Ss had the book open in front of them]

May I remind you again of the basic rules in surveying behavior. These must be understood before you begin the study. You must read all bold-faced headings and the first sentence under each bold-faced heading. You are to read no more or no less than that amount of work. If you continue to read beyond the first sentence, you are in error-you are not doing it properly. Please ignore all tables, charts, graphs, maps, and illustrations. If an example is listed and it has a title or example and this constitutes a bold-faced heading, then you may read the example and the first sentence or phrase underneath the word "example." At all times when you are reading the proper material you are to be reading aloud. Please read as clearly and distinctly as you can and yet read as you would like to in order to retain the material that you have read. At the end of each work unit you will be given a test over that material. It will be a test to see if you have surveyed properly. If you survey properly the test will be in your favor. If you have surveyed improperly or incorrectly, it will be harder for you on the test. So it is important that you do the surveying properly. When you complete the work unit, namely when you have read the first sentence of the last sub-heading, then you should close the book and say "I would like the test now." You will be given a test which you may take and then return and continue with the next work unit. There are a total of 15 work units which you will be asked to accomplish and when you have done so the session will be over. Let me remind you again of the survey pattern. Read the bold-faced headings and the first sentence of each bold-faced heading, no more - no less. Read aloud. When you are through reading the last word in the first sentence of the last sub-heading under any given work unit then you say "I would like the test now." After you take the test, you may then proceed with the next work unit."