DOCUMENT RESUME

ED 044 358 SP 004 315

AUTHOR	Carlson, Ralph M.; And Others
TITLE	A Report of the Experienced Teacher Fellowship Program on the Effects of Reinforcement on Regular Classroom Academic Performance.
INSTITUTION	Oregon Univ., Eugene.
SPONS AGENCY	Office of Education (DHEW), Washington, D.C. Bureau of Educational Personnel Development.
REPORT NO	Monograph-1
PUB DATE	Jun 70
GRANT	OEG-0-9-470117-3664(721)
NOTE	100p.; Experienced Teacher Fellowship Program in Learning and Behavior Problems
EDRS PRICE	EDRS Price MF-$0.50 HC-$5.10
DESCRIPTORS	*Academic Performance, Grade 3, Intelligence, Reading Speed, *Reinforcement
IDENTIFIERS	Stanford Binet Intelligence Test Form L M

ABSTRACT

A study was designed to investigate the effects of a token reinforcement system on the academic performance of a regular third grade classroom (N=22). Two performance tasks were used: oral reading from standard classroom materials and a unique task (a series of sound-symbol associations) designed to study acquisition and retention. The experimental design used subjects as their own controls on repeated measures across the three conditions (three 2-week phases) of baseline reinforcement, and return-to-baseline. Statistical and descriptive analyses were conducted on the data (oral reading rates for both tasks across the three experimental conditions). Results were consistent with those found in previous studies using reinforcement procedures in that performance was significantly increased ($p<.05$) on both tasks under the reinforcing condition. The return to baseline condition produced differential effects as a function of tasks; these results were considered to be an effect of the difference in reinforcement available in the extra-experimental environment of the two tasks. There were no differences found in retention across the conditions after retention scores were corrected for acquisition. When results were examined as a function of IQ and baseline performance changes ($p<.01$) across conditions. (Implications for classroom instruction and further research are suggested. A 70-item bibliography is included.) (Author/JS)

COVER PAGE

Monograph No. 1

U.S.O.E. Grant No. OEG-0-9-470117-3664(721)

Monograph Title

A REPORT OF THE EXPERIENCED TEACHER FELLOWSHIP PROGRAM ON THE EFFECTS OF REINFORCEMENT ON REGULAR CLASSROOM ACADEMIC PERFORMANCE

Project Title

Experienced Teacher Fellowship Program

in Learning and Behavior Problems

June 1970

U. S. Department of

Health, Education, and Welfare

Office of Education

Bureau of Educational Personnel Development

TITLE PAGE

Monograph No. 1

A REPORT OF THE EXPERIENCED TEACHER FELLOWSHIP PROGRAM ON THE EFFECTS OF REINFORCEMENT ON REGULAR CLASSROOM ACADEMIC PERFORMANCE

U.S.O.E. Grant No. OEG-0-9-470117-3664(721)

by

Ralph M. Carlson
Assistant Project Director

James M. Hotchkiss
Project Director

Hill M. Walker

June 1970

The research reported herein was performed pursuant to a grant with the Office of Education, U. S. Department of Health, Education, and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

University of Oregon

Eugene, Oregon

CHAPTER ONE

RATIONALE

Statement of Problem

An overwhelming amount of data indicates that the consequence a behavior receives will influence the probability of that behavior's future occurrence. In fact, this principle may be one of the few from the field of psychology that approaches the status of a behavioral law (Skinner, 1953). Although these data have not gone completely unnoticed in education, there has been little, if any, research conducted in regular classroom learning situations where the consequences or reinforcement variable has been experimentally manipulated to increase academic performance. The present study was designed to examine regular classroom academic performance under experimentally manipulated conditions of reinforcement and non-reinforcement.

Although there have been literally hundreds of studies of the application of reinforcement theory in classroom settings, the majority of these studies have dealt with non-academic behaviors. The studies of Becker, Madsen, Arnold, and Thomas (1967), Brown and Elliot (1965), Patterson, Ebner, and Shaw (1969), O'Leary, Becker, Evans, and Sandargas (1969), Schmidt and Ulrich (1969), Ullmann and Krasner (1965), and Krasner and Ullmann (1965) have focused primarily on decelerating non-academic types of behavior that were considered to be disruptive to

learning in a classroom setting. Most of these researchers also implemented programs designed to accelerate or increase behaviors which might be conducive to learning, such as attending, sitting in seat, and not talking out in the classroom. An increasingly large number of studies have dealt with very specific behaviors, such as isolate behavior (Allen, Hart, Joan, Harris, & Wolf, 1964), crawling (Harris, Johnston, Kelly, & Wolf, 1964), scratching (Allen & Harris, 1966), school phobia (Patterson, 1965), attending (Walker & Buckley, 1968), thumbsucking (Baer, 1962), tantrum (Williams, 1959), speech (Risley & Wolf, 1967), and stuttering (Flanagan, Goldiamond, & Azrin, 1958).

There have been several attempts to establish classroom learning environments based on reinforcement theory. Most of these have centered around constructing classrooms for exceptional children, primarily learning disabilities, emotionally disturbed, and mentally retarded (Walker, Mattson, & Buckley, 1969; O'Leary & Becker, 1967; Birnbrauer, Wolf, Kidder, & Tague, 1965; Quay, Werry, McQueen, & Sprague, 1966; Wolf, Giles, & Hall, 1968; Zimmerman & Zimmerman, 1962; Hotchkiss, 1966; Hewett, Taylor, & Artuso, 1969). Also, most of these classrooms have been set up to control or reduce the amount of deviant behavior in the anticipation that the children would learn better if most of these behaviors were decreased. In all of these classrooms, reinforcement was given for emitting appropriate academic responses, but the reinforcement was not manipulated specifically for academic behavior, therefore necessarily limiting any statements that could be made about the effects of reinforcement on academic performance.

Almost all of these studies reported significant academic gains made by the children when the reinforcing conditions were in effect. O'Leary et al. (1969), in reporting on the academic gains made by children operating under a token reinforcement system aimed at reducing disrupting behaviors, found that the mean gain from October to September on the California Achievement Test was 1.5 years. They went on to say, "While such gains are promising, conclusions about the effects of a token system on academic performance must await a more systematic analysis [p. 12]."

In a recent study, Zimmerman, Zimmerman and Russell (1969) report, "To our knowledge, no published study has employed a procedure that exclusively involved the concurrent exposure of all class members to a single, specific set of differential reinforcement contingencies [p. 101]." They go on to say that "the obvious need to facilitate the efficient instruction of an entire group of students under conditions in which behavior in each class member can be monitored and examined as a function of common instructional procedures and common treatments, gave impetus to the present study [p. 101]." The study to which Zimmerman et al. were referring examined the effects of several different reinforcers on the direction-following behavior of seven retarded boys. Four of the seven Ss changed significantly as a function of a token reinforcement system and the three others were unaffected. Since the classes in the studies described above dealt with exceptional children with individually tailored programs, the setting could not be considered an actual classroom learning situation.

A small number of studies have dealt with the direct acquisition of academic behaviors. The work done by Lovaas (1964) in teaching speech and language to mute psychotic children using reinforcement procedures would be an example of this type. In a study designed to examine the effect of contingent and non-contingent reinforcement on academic performance in delinquents, Tyler and Brown (1968) found that contingent reinforcement produced significantly higher performance. Their criterion test used 10 true-false questions, and although the findings were statistically significant, the educational significance is questionable. The contingent reinforcement procedure produced mean gains of less than one test item.

In an early study, Hewett (1964) was able to teach a rudimentary sight vocabulary and handwriting skills to a 14-year-old non-verbal autistic boy by using operant conditioning techniques. This boy, who had never acquired speech, learned to request things in writing and to follow simple written commands. Whitlock (1966) used a token system to produce substantial gains in reading behavior in a six-year-old boy. In a replication of this study, Whitlock and Bushell (1967) found that the reading behavior of the S increased "more than two and one-half times when the S selected his own reinforcers from an array of back-up items [p. 56]."

An impressive series of studies conducted by Staats and his associates (Staats, Staats, Schutz, & Wolf, 1962; Staats, Minke, Finley, Wolf, & Brooks, 1964; Staats, Finley, Minke, & Wolf, 1964; Staats & Butterfield, 1965; Staats, Minke, Goodwin, & Landeen, 1967) have

applied reinforcement theory to reading instruction across a wide variety of subjects ranging in age from four to 15. In one of the studies, Staats et al. (1967) used sub-professional therapy clinicians to implement a token reinforcement program with 18 subjects (mean age 14 years 6 months) exhibiting reading deficits. In this study, Ss earned tokens for reading and answering comprehensive questions correctly. SRA reading materials were used and the primary criterion measure given pre and post was a list of 100 words drawn from the SRA materials. The mean number of word reading responses made by Ss during this study (38.2 hours) was 94,425. The mean improvement for the group (N = 18) on the 100 SRA words was 12.2 words (63.8-76.1). In a test of long-term retention, 70.9% of the new words learned by Ss were retained. It is interesting to note that, even though the amount of reinforcement given was reduced across the duration of the study, the rate of reading increased. Here again, these studies cannot be actually considered the application of reinforcement theory to classroom learning situations because of the very small N's used, generally not more than five, and the strict laboratory conditions under which the research and implementation were carried out.

In summary, research on reinforcement theory in classroom settings has in the past involved 1) regular classroom settings but non-academic behaviors, 2) classroom settings but exceptional children with individually tailored programs, and 3) direct acquisition of academic behavior but not in a regular classroom. Several authors have stressed the importance of making reinforcement procedures available to regular

classroom teachers. As Quay et al. (1966) state, "The economics of public schools obviously require the development of techniques that will allow children to be handled in a group situation by as few adults as possible...[p. 513]." Karraker (1968) points out that "Although virtually every published report of token systems claims unqualified success..., the extent to which token systems can be employed by the regular public school classroom teacher...has not been explored [p. 1]." The sheer number of children in public school classrooms requires that teachers use educational procedures that are both powerful and efficient. Therefore, the present study was designed to examine the extension of reinforcement principles to regular classroom academic acquisition and performance under conditions of reinforcement and non-reinforcement.

Related Research

Reinforcement

Reinforcers: The literature on educational research is filled with studies designed to discover the best methods of increasing children's performance in specific skill areas (Gurren & Hughes, 1965; Dykstra, 1968). The majority of this research has focused on differences in the instructional events or sequence of materials which precede the actual performance of the child (Evans, 1968; DeCecco, 1968). However, another way to increase classroom performance is to reinforce the child's performance. As Estes (1960) puts it: "Whatever the outcome of the various continuing attempts to construct explanatory theories

of the learning process, there can be no doubt that the practical management of learning in any situation requires detailed knowledge and control of reinforcing operations [p. 758]."

A wide variety of consequent events has been shown to function as reinforcers for a variety of behaviors in young children. Praise and teacher attention have been widely used in controlling the behavior of children (Allen et al., 1964; Becker et al., 1967; Brown & Elliot, 1965; Hall & Broden, 1967; Harris et al., 1964; Reynolds & Risley, 1968; Zimmerman & Zimmerman, 1962; Zimmerman, Zimmerman, & Russell, 1969). Other consequences that have had demonstrated reinforcing effects would include candy (Hewett, 1964), trinkets (Staats et al., 1962), a combination of both (Bijou & Sturges, 1959), earned activities, (Homme, deBaca, Devine, Steinhorst, & Rickert, 1963), and free time (Osborne, 1969).

In an earlier study designed to assess the effects of different reinforcing contingencies on verbal learning in retarded subjects, Martson and Sage (1965) found no significant differences in performance across conditions. Their manipulated reinforcement conditions were candy, verbal praise, grades, verbal reproof, and neutral. They concluded that there was no "best" reinforcement condition for the retarded population. One of the explanations offered for their findings was that the intersubject variance was high enough to cancel out any intrasubject variance that may have occurred.

Token economy: One way to circumvent the problem of empirically identifying a reinforcer for each member of an experimental population

is to use a token economy (Birrbrauer et al., 1965; O'Leary & Becker, 1967; O'Leary et al., 1969; Quay et al., 1966; Wolf et al., 1968; Staats & Butterfield, 1965· Staats et al.,. 1967; Zimmerman et al., 1969; Whitlock, 1966; Haring & Kunzelmann, 1966; Zimmerman & Zimmerman, 1962; Whitlock & Bushell, 1967; Walker et al., 1969).

The token system uses a token of some type (points, slips of paper, poker chips, etc.) which can be used to purchase items from a store containing a wide variety of items. The token is often referred to as a generalized reinforcer because it functions as a discriminative stimulus by informing the individual that a variety of reinforcers are available (Millenson, 1968). The token system appears to gain its power from its ability to make many potentially reinforcing events available to the child simultaneously, thus compensating for changing conditions of deprivation (Bijou & Baer, 1966; Ferster & Skinner, 1957; Ayllon & Azrin, 1968; Haring & Kunzelmann, 1966). A token system was used in this study and will be discussed in detail later.

Related Variables

In the study by Mattson and Sage (1965), the children obtained their highest scores during the first block of trials, regardless of what reinforcement condition was in effect. They concluded that novelty, or the Hawthorne effect, may have obscured all other findings. They made the following recommendations for future research which were incorporated in the research design of the present study:

> Teacher: A larger sample of learning behavior, dealing with more familiar stimuli, within the regular classroom, with the regular teacher would minimize the novel stimuli

> effects which may have obscured all else in this study. The recognized loss of standardized procedure and controls inherent in such an approach might be well compensated by the gain in discriminative power of a longer and more reliable criterion task, in maintaining the customary setting for instruction and in making any significant results which might be found more directly applicable to classroom instruction [p. 70].
>
> Warm-up: Quite different results might be expected, even utilizing the same novel situation, if subjects were exposed to a greater amount of 'warm-up' on such a situation so that most of the novelty would be dissipated before the effects of differential reinforcement contingencies were evaluated. Such a procedure would also allow the equating of groups on a base line performance, rather than resorting to the apparently inadequate criteria of mental age and intelligence [p. 70].

One problem encountered in much educational research is the inability of the experimenter to obtain a criterion measure sensitive enough to detect relatively short-term treatment effects. In a study previously referred to (Staats et al., 1967), the mean gain on the criterion measure was 12.2, although the subjects had made over 94,000 responses during the study. Tyler and Brown (1968) report, "Previous efforts by the investigator to produce improved academic performance with token reinforcement showed no results, presumably because of inadequate controls, particularly with regard to the measurement of the criterion [p. 167]."

Because of the limited duration of the present study, the use of a performance measure capable of detecting short-term effects was essential. Response rate has been shown to be an extremely sensitive measure and is applicable across a wide variety of behaviors (Skinner, 1966). Haughton (1969) outlines several advantages in using rate data in educational settings. 1) Rate yields not only a measure of accuracy,

but also of proficiency. 2) Rate, unlike percentage, has no absolute ceiling. 3) Rate is more sensitive in detecting change than is percentage. Therefore, response rate was chosen for use in this study.

Additional Independent Variables

IQ: Research in the past has largely concentrated on variables other than reinforcement. The initial educational research aims seem to be that of predicting--predicting which children would learn to read, which children would succeed, which children would go to college--but the general focus was on measurement and prediction. There was a heavy concentration on the construction of measures that would allow for prediction in a classroom learning situation, best exemplified by the development and research of intelligence tests. To the extent that predictive research is an attempt to discover the causative or etiological factors underlying low academic performance, these findings have very little to say that will help the educator. As Haring and Hauck (1969) state in regard to reading,

> There are widely varying reading deficits among children which might result from either biological or experimental factors. By the time reading behavior becomes important to children, however, it is far too late to be concerned about etiology. The concern to the educator is with procedures which will predictably establish reading responsen...[p. 341]."

Intelligence test score data were examined in the present study for the reasons outlined by DeCecco (1968):

> First, the use of intelligence tests is very widespread in American education....Second, an impressive amount of educational research has attempted to establish relationships between scores students achieve on intelligence tests and the scores these same students obtain on

> a host of achievement, special aptitude, personality, and attitude tests and on other inventories. Third, the student's IQ has been the basis for many educational decisions on grade, track placement...and it has also been the basis for predictions about ultimate academic success (or failure) in one's career or profession. Fourth, intelligence tests are major diagnostic devices for separating the bright and dull students [p. 84].

Baseline performance: One possible reason for low performance in the classroom setting might be that the events relating to learning that occur in the regular classroom may not have sufficient reinforcing value for some children. These children would generally be described by the classroom teacher as "not motivated" or as having learning problems. These same children might very well have IQ's in the normal or above normal range, but not perform up to their expected level. They would probably be diagnosed as learning disabled or emotionally disturbed, depending on what other behaviors they concurrently displayed in the classroom and extra-classroom environment (Bateman & Schiefelbusch, 1970). In the present study children with low performance were identified and the effects of the reinforcement procedures on their academic performance were examined.

Formal Problem Statement

The present study was designed to investigate the differential effects of reinforcement contingencies on the acquisition of reading performance under unique and standard reading tasks. Reading was selected for use in this study because of its importance in determining a child's success or failure in school (Fitzsimmons, Cheever, Leonard, & Macunovich, 1969). The study was essentially multivariant

in design insofar as variables other than reinforcement were examined. The initial analysis of the data was carried out to ascertain whether or not reinforcement produced a difference in performance across a group of 22 third-grade children on two performance tasks related to reading. One task was oral reading from published materials (which could be considered a daily task in the third-grade classroom) and the second task was a unique reading task designed essentially to study the problem of acquisition. In the Unique Task, sounds within the repertoire of the children were paired with symbols and "reading" was taught as in initial reading instruction under conditions of reinforcement and non-reinforcement. Another analysis was carried out to examine variables which accounted for the differences obtained in the first analyses. Children were then selected on the basis of IQ and initial performance and their later performance was evaluated to determine if differential effects of reinforcement occurred as a function of IQ and/or initial performance.

CHAPTER TWO

METHOD

In addition to the pilot studies and a pre-experimental phase, this study was divided into three two-week phases: 1) Baseline, 2) Reinforcement, and 3) Return-to-Baseline. The procedure followed in each phase was the same except for the addition of reinforcement in Phase II. During each phase, a standardized teaching lesson was taught and data were collected on both a Standard Task and a Unique Task (see Figure 1).

- - - - - - - - - - - - - -
Insert Figure 1 about here
- - - - - - - - - - - - - -

Subjects and Setting

One of the primary problems encountered in conducting meaningful (focus on specific variables accompanied with satisfactory control) research in the classroom has been the inability of the teacher to follow specific instructions and maintain standardized research procedures. Therefore, the teacher taking part in this study was selected on the basis of her knowledge in the area of behavior modification and experimental procedures.[1] Because of the intricate nature of this study, the experimenter deemed experimental control and procedure communications more important than the random selection of subjects. Because

PHASE I -- BASELINE -- WEEK 2

Mon.	Tues.	Wed.	Thurs.	Fri.
Standard Task Standardized Lesson Unique Task (acquis.)	Standard Task Standardized Lesson	Standard Task Standardized Lesson Unique Task (acquis.)	Standard Task Standardized Lesson	Standard Task Standardized Lesson Unique Task (acquis.)

PHASE I -- BASELINE -- WEEK 3

Mon.	Tues.	Wed.	Thurs.	Fri.
Standard Task	Standard Task	Standard Task	Standard Task	Unique Task (reten.)

PHASE II -- REINFORCEMENT -- WEEK 4

	Mon.	Tues.	Wed.	Thurs.	Fri.
Store in place	Standard Task Standardized Lesson Unique Task (acquis.)	Standard Task Standardized Lesson	Standard Task Standardized Lesson Unique Task (acquis.)	Standard Task Standardized Lesson	Standard Task Standardized Lesson Unique Task (acquis.)

PHASE II -- REINFORCEMENT -- WEEK 5

Mon.	Tues.	Wed.	Thurs.	Fri.
Standard Task	Standard Task	Standard Task	Standard Task Store removed	Unique Task (reten.)

PHASE III -- RETURN-TO-BASELINE -- WEEKS 6 AND 7

Same as weeks 2 and 3

Fig. 1. Sequence of procedures across the duration of the study.

of the need for precise experimental control, only one classroom was used in this study. It was assumed that one classroom in which experimental control could be assured would provide more valid and reliable information than would several classrooms in which experimental control could not be assured. It is further acknowledged that, because the experimental sample was not randomly selected, the generalizability of the study has been reduced.

A third-grade class in the Bethel school district was used in this study (N = 26). This school district is located in an area adjacent to and partially included in the city of Eugene, Oregon. Two of the larger industrial areas of the county are located within the district limits. Parts of the district are characterized by low-income families and sub-standard housing and can be described as the workingman's part of Eugene, where many blue-collar workers reside. The district has been characterized by change in the past 10 years because of a growing industrialization and the deterioration of some housing areas. Urban renewal projects are presently proposed to improve some of the residential areas. The school which the Ss attended draws its population from a transient urban area; during the 1968 to 1969 year, the school had an average enrollment of 273 children, with 88 pupils withdrawing and 84 new students entering within the year. Nearly eight percent of the school's population is culturally deprived; over 30 percent of the children come from single-parent families.

The experimental subjects had a mean age of nine years one month, with a range of eight years five months to nine years eleven months.

The IQ distribution for Ss had a mean of 100, with a range of 74 to 129. On the vocabulary and comprehension sections of the Gates-MacGinitie Reading Test, the experimental subjects had a mean grade level score of 2.5, with a range of 1.4 to 4.4. The mean grade score of 2.5 years indicated that the experimental population averaged approximately one year below expected grade level in reading. There were 13 boys and nine girls, and classroom grouping was heterogeneous in terms of ability. The Sullivan Reading Program was used in their regular classwork.

Materials and Apparatus

The Standard Task consisted of nine selections from the orange level of Science Research Associates (SRA) Reading Laboratories, level IIb, which were repeated under each of the three experimental conditions. The Standardized Teaching Lesson (See Appendix A) was prepared by E in conjunction with several teachers. It attempted to take into account the variables for the construction of a good lesson, such as response mode, response rate, maximum discriminability, review, chaining, and meaningfulness (Silberman, 1965). This lesson was then tested in a series of pilot studies to ascertain teachability.

The Unique Task consisted of a series of 15 sound-symbol associations, five of which were used in each experimental condition. The symbols chosen for use in the Unique Task learning situation were chosen for two reasons: 1) maximum discriminability (judged by E and several first grade teachers), and 2) standardization (the symbols are available for IBM selectric typewriters equipped with the interchangeable

typing ball, "Symbol 12"). The symbols used were the following:

λ ≡ Γ Δ ϕ Τ θ Λ Ω Ψ π ∂ δ § ∝

The sounds to be taught in association with the symbols were chosen on the basis of maximum auditory discriminability as well as demonstrated learning potential; i.e., the sounds that children consistently confuse (d, p, n, m) were purposefully omitted from this study. The sound-symbol combinations were pure in that each symbol was associated to only one sound, a condition which parallels the procedure and process used in teaching initial reading using a phonic method. The sounds that were used were the following:

/z/ as in zebra	/a/ as in apple	/o/ as in hot
/i/ as in sit	/t/ as in teen	/s/ as in sew
/m/ as in money	/d/ as in dog	/b/ as in baby
/c/ as in car	/f/ as in far	/j/ as in jug
/l/ as in laugh	/r/ as in run	/g/ as in game

The sounds were assigned to the symbols by randomly selecting a sound and a symbol from two containers. The resulting combinations were the following:

/a/ - π	/o/ - Ω	/i/ - Δ
/t/ - θ	/m/ - λ	/b/ - δ
/c/ - ∂	/s/ - Λ	/f/ - Γ
/j/ - §	/l/ - Ψ	/r/ - ≡
/g/ - Τ	/d/ - ∝	/z/ - ϕ

The sound-symbol combinations were then assigned to the three conditions by random selection and assignment.

I	II	III
/s/ - Λ	/i/ - Δ	/c/ - ∂
/r/ - Ξ	/z/ - ϕ	/t/ - θ
/m/ - λ	/j/ - §	/o/ - Ω
/b/ - δ	/f/ - Γ	/g/ - Τ
/a/ - π	/l/ - Ψ	/d/ - ∝

The apparatus included 1) a Sony model 99 tape recorder used to record teaching lessons and the children's performance on the Unique Task, and 2) stop watches used to time the data collection period for both the Standard and Unique Tasks.

Tests

IQ scores were obtained by the Stanford-Binet Intelligence Test, Form L-M. Acquisition[2] and Retention[3] of the Unique learning task were tested by having the children read "words" constructed of the new symbols. During acquisition in each phase, three lists of the same words in different order were used for testing. A fourth list of the same words was used for testing retention. The word lists were constructed controlling the following factors:

A. Number of items

B. Type of items

1. Length
2. Meaningfulness
3. Pronounceability
4. Consonant-vowel sequences

Data Collection and Recording

Standard Task

Each S read orally to the teacher for a two-minute period each day. The reading selections (SRA IIb) were rotated so that each child read a different selection each day of the phase and further rotated so that the same selection was not read by the entire group during one day. The children came one at a time, in alphabetical order, to the teacher's desk in the rear of the room. Those remaining in their seats worked on regular classroom assignments in the Sullivan Reading Program. The teacher directed the child to begin, and a stopwatch was used for timing. The teacher recorded the number of words read correctly, number of words read incorrectly, and total number of words read on a printed form (Sample form in Appendix B).

Unique Task

The data were collected by a trained observer and all sessions (lesson and testing) were recorded on tape to allow E to check for reliability. The lists were rotated so that each S read a different list each time and also rotated during a day so that the entire group did not read the same list. The children read until the following criteria were met:

1. Read at least 12 words
2. Read for 2 minutes

The observer directed each S to say his name first and then begin reading the words. A stopwatch was used for timing and a tape

recorder was used for recording the sessions. The observer recorded total number of words and symbols read, number of words and number of symbols read correctly, and number of words and number of symbols read incorrectly on a form (Sample form in Appendix C). The testing was done in a three-sided study booth to the side of the classroom. The booth was constructed with its open side to the wall so that the class was not visible from within the booth.

In order to facilitate a more rapid progression of individuals coming to the booth to read to the observer, a large chart with each child's name listed was posted. After a child finished reading, he checked off his name on the chart and called the person whose name followed his.

Reinforcement

The manipulated reinforcement used in this study was defined as tokens children received on a contingent basis, that could be exchanged for candy, trinkets, etc., in a store contained in the classroom. Verbal praise was also controlled for all conditions and was only given during Phase II. Reinforcement in the form of knowledge of results was partially restricted; i.e., during Phase I and Phase III, the subjects were told neither their number correct nor which items were correct; during Phase II, the subjects were told their numbers correct, but not told which items were correct. Thus, the reinforcement variable controlled in this study was a combination of tokens, verbal praise, and feedback.

The store items (see Appendix D) were selected by the following procedures: 1) The children in the class were asked to write down three things that they wanted, including their favorite candy bar. 2) The children were asked to bring items (toys) from home to play with in school. This was done on four consecutive Fridays over a period of one month. Frequency counts were then taken on the number of children who played with each of the toys. 3) Free-time activities and toys were made available to the children and frequency counts were taken on the number of children who selected each item. The items that the children selected most frequently were selected for inclusion in the store to be used as back-up reinforcers for the tokens.

The store was set up on top of large shelves where it was easily visible to the children. Items except those priced at 100 tokens were in boxes labeled with the price; items priced at 100 tokens were arranged on the shelf but not in the box. The store was present in the classroom only for the nine-day duration of Phase II of this study.

A period of time (2-2:30) was set aside each day during the Reinforcement phase for the subjects to buy items from the store. The subject's name was called, he chose the item he wanted to buy from the store, and he then paid the teacher who recorded the date, item bought, and the price.

Experimental Procedures

Pilot Study

Three two-week pilot studies were conducted to determine the following:

1. How well could a teacher use the standard teaching lesson?
2. How long did the lesson take?
3. Were all of the children able to learn some of the sound-symbol relationships?
4. Were any of the children able to achieve 100 percent correct on the criterion tests?

The pilot studies used three different teachers and 35 children in grades one through six. The results and subsequent changes in procedure were as follows:

1. The three teachers who took part in the pilot studies reported that the standard lesson was easy to follow and "fun" to use. Tape recordings of these lessons confirmed this. Two changes were made in the lessons: a) verbal praise was eliminated during Phase I and Phase III, and b) to induce more group response, the words, "Now everybody say it," were added to the lesson.

2. The lesson took a mean time of nine minutes to teach. The range was from seven to 12 minutes.

3. All of the children taking part in the pilot study were able to obtain correct answers on the criterion tests after one teaching session.

4. Some of the children obtained 100 percent correct on the paper and pencil criterion tests after one instructional period, and most of the children obtained 100 percent correct after several sessions. Because of the relatively low ceiling and other problems of a validity nature, the criterion tests were changed from a paper-and-pencil test to oral reading of words constructed from the new symbols. Data were collected on the number of words read correctly per minute and the number of words read correctly out of a total of 12 words.

Pre-Phase

A lesson (see Appendix E) similar to the experimental lesson was presented during the first week of the study (Week One). It was designed to acclimate the subjects and the teacher to the procedures. It was also used to test the feasibility of data collection techniques. As a result, it was discovered that the automatic data recording system (i.e., subjects reading into tape recorder) was unreliable, and an observer as well as a tape recorder was necessary in the following conditions.

During the Pre-Phase, the Stanford-Binet Intelligence Test was administered to all subjects and graded by trained psychological examiners.[4]

Phase I: Baseline--Acquisition

Standard Task: During Weeks Two (Monday through Friday) and Three (Monday through Thursday) the subjects read orally for two minutes from SRA materials to the teacher as described in Data Collection and Recording.

Standardized lesson: The following five sound-symbol associations were taught and tape recorded each day of Week Two by the teacher, using the standardized lesson in group instruction:

/s/ - ʌ

/r/ - ɛ

/m/ - ɹ

/b/ - ɓ

/a/ - ɯ

Unique Task: Immediately following the standardized lesson on Monday, Wednesday, and Friday of Week Two, the subjects read individually from one of the three lists of "words" (A, B, or C, as seen in Figure 2) to a trained observer as described in Data Collection and Recording.

Insert Figure 2 about here

Phase I: Baseline--Retention

Unique Task: At Week Three (Friday), and using the same procedure as described above under Unique Task, the subjects read individually from the list of "words" (Figure 3), using the same words as in Week One, but in a different order.

Insert Figure 3 about here

Phase II: Reinforcement--Acquisition

Token economy: The store as described under Reinforcement was put into place before the children arrived Monday of Week Four (Monday

A

ΠΛΠλ	ΠδΞΠ	ΠΛδΠ	ΠλΠΛ	ΠδΠΛ
ΞΠδΠλ	λΠΛΠδ	ΛΠλΠδ	ΞΠΛΠλ	ΞΠλΠδ
ΛΠδ	ΞΠΛ	λΠδ	ΞΠδ	λΠΛ
Πδ	δΠ	ΞΠ	ΛΠ	λΠ
δΠλΠΛ	ΞΠδΠΛ	ΛΠΛΠλ	ΞΠλΠδ	ΞΠΛΠδ
ΞΠΛΠ	ΛλΠδ	ΞΠλΠ	δΞΠλ	δΞΠΛ

B

ΞΠλΠ	ΞΠΛΠ	δΞΠΛ	ΛλΠδ	δΞΠλ
ΞΠλΠδ	ΞΠδΠΛ	δΠλΠΛ	δΠΛΠλ	ΞΠΛΠδ
λΠ	ΞΠ	δΠ	ΛΠ	Πδ
ΛΠδ	ΞΠδ	λΠδ	λΠΛ	ΞΠΛ
λΠΛΠδ	ΞΠλΠδ	ΞΠΛΠλ	ΞΠδΠλ	ΛΠλΠδ
ΠΛδΠ	ΠΛΠλ	ΠδΠΛ	ΠδΞΠ	ΠλΠΛ

C

ΠδΠΛ	ΠλΠΛ	ΠΛδΠ	ΠδΞΠ	ΠΛΠλ
ΞΠΛΠλ	ΛΠλΠδ	λΠΛΠδ	ΞΠδΠλ	ΞΠλΠδ
λΠδ	ΞΠΛ	ΛΠδ	λΠΛ	ΞΠδ
δΠ	Πδ	λΠ	ΛΠ	ΞΠ
δΠλΠΛ	ΞΠΛΠδ	ΞΠλΠδ	δΠΛΠλ	ΞΠδΠΛ
δΞΠΛ	δΞΠλ	ΞΠλΠ	ΛλΠδ	ΞΠΛΠ

Fig. 2. Lists of "words" for Unique Task (acquisition), Phase I, Baseline.

R

δΞπλ	Λλπδ	δΞπΛ	Ξπλπ	Ξπλπ
Ξπλπδ	δπΛπλ	δπλπΛ	Ξπδπλ	Ξπλπδ
Λπ	δπ	Ξπ	λπ	πδ
λπΛ	λπζ	Ξπδ	Λπδ	Ξπλ
Ξγληλ	⁼πλ⁼δ	λπΛπζ	Λπλπδ	Ξπζ⁼λ
ηδπλ	πΛπλ	πΛζγ	πλπΛ	Ξπδπλ

Fig. 3. List of "words" for Unique Task (retention), Phase I, Baseline.

through Friday) and removed after the children went home on Thursday of Week Five (Monday through Thursday).

Standard Task: The same procedure was employed as in Phase I but with the addition of reinforcement. Verbal praise and knowledge of results were given to each subject following his two-minute reading session. Tokens were also given for increases in correct reading rate, with one token being awarded for each word per minute increase.

Standardized lesson: The same procedure was employed as in Phase I, with the addition of reinforcement. Terms such as "good" and "very good" were included in presenting the lesson. The following sound-symbol associations were taught:

/i/ - Δ

/ɛ/ - ϕ

/j/ - ξ

/f/ - Γ

/l/ - Ψ

Unique Task: The same procedure was employed as in Phase I, but with the addition of reinforcement. Both verbal praise and knowledge of results were given each child by the observer. One token was given for each "word" read correctly; i.e., the reinforcement schedule was an FR1. The "word" lists used are seen in Figure 4.

Insert Figure 4 about here

A

ΔϕΔΓ	Δ$ΔΨ	ΔΓΔ$	ΔΨΔϕ	ΔΓΨΔ
$ΔΨΔϕ	ΨΔΓΔ$	$ΔΓΔϕ	ΓΔϕΔΨ	ϕΔ$ΔΓ
ΨΔΓ	$Δϕ	ϕΔΨ	ΓΔ$	ΨΔ$
Δϕ	ΓΔ	Δ$	ϕΔ	ΨΔ
$ΔΓΔΨ	ΓΔ$Δϕ	ϕΔΨΔ$	$Δϕ$ΔΓ	ΓΔΨΔϕ
$ΔΨΓ	ϕΔΨ$	ΓΨΔϕ	$ΔΨϕ	ϕΨΔΓ

B

ΔΓΨΔ	ΔΨΔϕ	ΔΓΔ$	Δ$ΔΨ	ΔϕΔΓ
ΓΔϕΔΨ	$ΔΓΔϕ	ΨΔΓΔ$	$ΔΨΔϕ	ϕΔ$ΔΓ
ϕΔΨ	$Δϕ	ΨΔΓ	ΨΔ$	ΓΔ$
ΓΔ	Δϕ	ΨΔ	ϕΔ	Δ$
$ΔΓΔΨ	ΓΔΨΔϕ	$Δϕ$ΔΓ	ϕΔΨΔ$	ΓΔ$Δϕ
ϕΨΔΓ	$ΔΨϕ	ΓΨΔϕ	ϕΔΨ$	$ΔΨΓ

C

ΓΨΔϕ	$ΔΨϕ	ϕΨΔΓ	$ΔΨΓ	ϕΔΨ$
$ΔϕΔΓ	ΓΔΨΔϕ	$ΔΓΔΨ	ΓΔ$Δϕ	ϕΔΨΔ$
ΨΔ	Δϕ	ΓΔ	Δ$	ϕΔ
ΨΔΓ	$Δϕ	ϕΔΨ	ΓΔ$	ΨΔ$
ΨΔΓΔ$	$ΔΓΔϕ	ΓΔϕΔΨ	ϕΔ$ΔΓ	$ΔΨΔϕ
ΔΓΔ$	ΔΨΔϕ	ΔΓΨΔ	ΔϕΔΓ	Γ$ΔΨ

Fig. 4. Lists of "words" for Unique Task (acquisition), Phase II, Reinforcement.

Phase II: Reinforcement--Retention

On Friday of Week Five the same procedure was employed as in Phase I, using the list of "words" in Figure 5, and no reinforcement was given during the retention test.

Insert Figure 5 about here

Phase III: Return-to-Baseline--Acquisition

During Weeks Six (Monday through Friday) and Seven (Monday through Thursday) the same procedure was employed as in Phase I, but with the following exceptions:

Standardized lesson: The following sound-symbol associations were used:

/o/ - ɑ

/g/ - ɪ

/c/ - ə

/t/ - θ

/d/ - ɑ

Unique Task (acquisition): The "word" lists shown in Figure 6 were used.

Insert Figure 6 about here

Unique Task (retention): The "word" list in Figure 7 was used on Friday of Week Seven.

Insert Figure 7 about here

R

ϕΔ▼$	$Δ▼Γ	ϕ▼ΔΓ	$Δ▼ϕ	Γ▼Δϕ
ϕΔ▼Δ$	ΓΔ$Δϕ	$ΔΓΔ▼	ΓΔ▼Δϕ	$Δ¢ΔΓ
Δ$	ΓΔ	Δϕ	▼Δ	ϕΔ
ΓΔ$	ϕΔ▼	$Δϕ	▼ΔΓ	▼Δ$
ΓΔϕΔ▼	$ΔΓΔϕ	▼ΔΓΔ$	$Δ▼Δ¢	ϕΔ$ΔΓ
ΔΓ▼Δ	Δ▼Δϕ	ΔΓΔ$	Δ$Δ▼	Δϕ$Γ

Fig. 5. List of "words" for Unique Task (retention), Phase II, Reinforcement.

A

ΩTΠϑ	ΩθΩ∝	Πϑ∩∝	Ω∝Πθ	ΩTΠθ
ϑΠθΠT	TΠ∝Πϑ	θΠTΩ∝	∝Πϑθ	TΠθΩ∝
TΠϑ	θΩ∝	θΠϑ	θΠT	∝Πϑ
ϑΩ	ΩT	Πθ	Ω∝	TΩ
ϑΠθΩ∝	TΩ∝Πθ	ϑΠTΠθ	∝Πϑ∩T	TΠϑΩ∝
TΠϑθ	TΠθΩ	∝Πϑ∩	θΩ∝Ω	ϑΠTΩ

B

Πϑ∩∝	Ω∝Πθ	ΩθΩ∝	ΩTΠθ	ΩTΠϑ
TΩ∝Πϑ	θΠTΩ∝	ϑΠθΠT	∝Πϑθ	TΠθΩ∝
ϑΩ	ΩT	TΩ	Πθ	Ω∝
TΠϑ	θΩ∝	∝Πϑ	θΠϑ	θΠT
TΩ∝Πθ	ϑΠTΠθ	ϑΠθΩ	∝Πϑ∩T	TΠϑΩ∝
∝Πϑ∩	θΩ∝Ω	TΠθΩ	ϑΠTΩ	TΠϑθ

C

ϑΠTΩ	θΩ∝Ω	∝Πϑ∩	TΠθΩ	TΠϑθ
TΠϑΩ∝	∝Πϑ∩T	ϑΠTΠθ	TΩ∝Πθ	ϑΠθΩ∝
TΩ	Ω∝	Πθ	ΩT	ϑΩ
∝Πϑ	ϑ∩T	θΠϑ	θΩ∝	TΠϑ
TΠθΩ∝	∝Πϑ∩θ	θΠTΩ∝	TΩ∝Πϑ	Πϑθ∩T
ΩTΠθ	Ω∝Πθ	Πϑ∩∝	Πθ∩∝	ΩTΠϑ

Fig. 6. Lists of "words" for Unique Task (acquisition), Phase III, Return-to-Baseline.

R

TΩθΩ	∝Ω∂Ω	θΩ∝Ω	∂ΩTΩ	TΩ∂θ
TΩ∝Ωθ	∂ΩTΩθ	∝Ω∂ΩT	TΩ∂Ω∝	∂Ωθ Ω∝
Ωθ	Ω∝	TΩ	∂Ω	ΩT
θΩ∂	θΩT	∝Ω∂	TΩ∂	θΩ∝
∝Ω∂Ωθ	TΩθΩ∝	∂Ωθ ΩT	TΩ∝Ω∂	θΩTΩ∝
Ω∝Ωθ	ΩTΩθ	ΩTΩ∂	Ωθ Ω∝	Ω∂Ω∝

Fig. 7. List of "words" for Unique Task (retention), Phase III, Return-to-Baseline.

CHAPTER THREE

RESULTS AND DISCUSSION

Reinforcement Effects on Academic Performance in a Regular Classroom

The introduction of reinforcement procedures in a regular classroom increased the children's performance on both the Standard and Unique reading tasks. As Table 1 illustrates, the mean performance for the experimental group (N = 22) was higher under the Reinforcement condition than under the Baseline condition.

Insert Table 1 about here

On both the Standard Task[5] (N = 22) and the Unique Task (N = 22), the single factor repeated measures Analysis of Variance (Winer, 1961) revealed significant differences across the three experimental conditions: Baseline, Reinforcement, and Return-to-Baseline.

Insert Tables 2 and 3 about here

Further, a technique developed by Scheffe (Kirk, 1968) was used to test for effects of reinforcement alone. It was found the performance (N = 22) under the Reinforcement condition was significantly different ($p < .05$) for both the Standard Task and the Unique Task. It is necessary here to comment on interpreting the reading of the graphs

TABLE 1

Group Means and Standard Deviations for the Unique and Standard Tasks across the Three Experimental Conditions

	Baseline	Reinforcement	Return-to-Baseline
Unique Task	M = 5.1 SD = 3.23	M = 5.8 SD = 2.60	M = 3.8 SD = 3.60
Standard Task	M = 56.1 SD = 27.40	M = 70.8 SD = 31.2	M = 78.6 SD = 34.6

TABLE 2

Analysis of Variance for the Standard Task across the Three Experimental Conditions of Baseline, Reinforcement, and Return-to-Baseline

Source	SS	df	MS	F
Between	62,958.31	21		
Within	7,067.87	44		
Across Phases	5,754.54	2	2877.27	92.01*
Residual	1,313.33	42	31.27	
Total	70,026.18	65		

*$p < .001$

TABLE 3

Analysis of Variance for the Unique Task across the Three Experimental Conditions of Baseline, Reinforcement, and Return-to-Baseline

Source	SS	df	MS	F
Between	534.51	21		
Within	167.65	44		
Across Phases	45.21	2	22.61	7.74*
Residual	122.44	42	2.92	
Total	702.16	65		

*$p < .01$

used in this paper. The same graph format (ordinate and abscissa) is used in presenting all of the data to better enable the reader to make direct comparisons between graphs. The graphs use a logarithmic scale; both absolute increases and proportional increases can be read directly from the graph. The dashed horizontal line appearing on the graphs at the .5 level is the record floor, which indicates the point on the graph where the subject made one correct response in the two-minute time sample used in this study. All data points plotted below the record floor are to be read as zero. Equal interval graphs of the major effects are provided for the reader who is more accustomed to this scale (Appendices F through K).

Insert Figure 8 about here

As shown in Figure 8, the experimental group (N = 22) showed increased performance on both tasks under the Reinforcement condition. In interpreting this graph, it should be remembered that the items on the Unique Task changed for each condition while the same material was used across conditions on the Standard Task.

Although the group (N = 22) as a whole showed increased performance under the Reinforcement condition on both tasks, individual differences were recorded. All of the children in this study increased in performance on the Standard Task under the Reinforcement condition; on the other hand, 17 of the 22 children increased in performance on the Unique Task under the Reinforcement condition. However, the five children whose performance decreased under the reinforcing procedure were in the

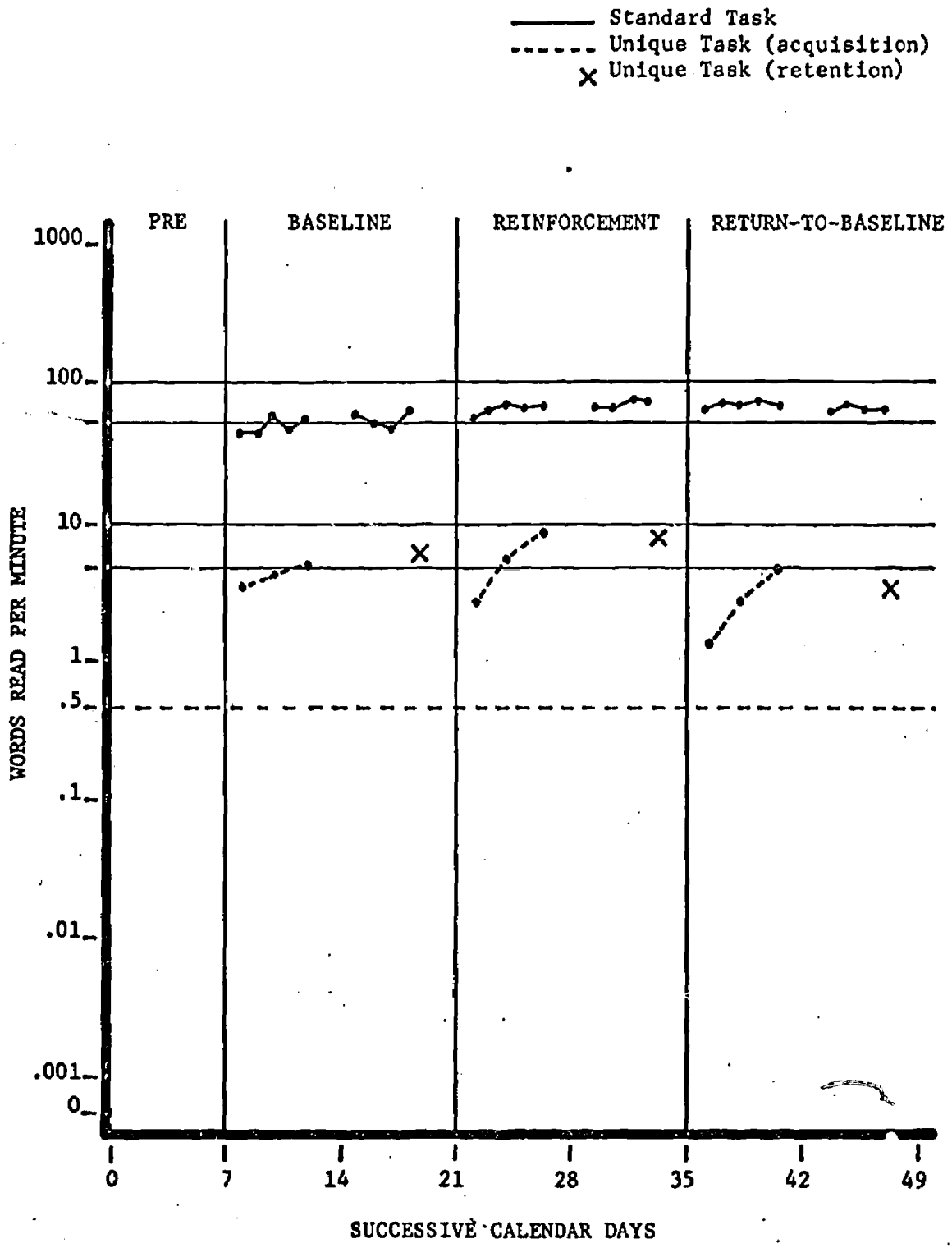


Fig. 8. Median scores of the 22 subjects on the Standard Task and on the Unique Task.[6]

upper 55% of the experimental group in their Baseline performance. Two of the five had higher mean rates under Reinforcement than Baseline, and three of the five had their highest individual score during the Reinforcement condition. The two remaining children exhibited higher mean and median scores in both Baseline and Return-to-Baseline than in Reinforcement, thus indicating that the effect of the procedure for these two children was actually decelerating. It was discovered toward the end of the Reinforcement Phase that one of these two children had been pilfering tokens, which may have adversely affected his performance.

In addition to showing increased performance under Reinforcement, Figure 8 further illustrates that under the Return-to-Baseline condition the performance rates continued to accelerate on the Standard Task, but decelerated on the Unique Task. Under the Return-to-Baseline condition, the differential effect on the two tasks is probably due to the difference in tasks or, more specifically, to the differences in the availability of reinforcement for the two tasks in the extra-experimental environment. The Standard Task, being essentially reading from regular classroom materials, would be much more likely to be maintained by reinforcement other than that directly manipulated in this study. The Unique Task, on the other hand, represented nonsense material with little, if any, opportunity for usage or reinforcement in the extra-experimental environment.

On the Standard Task the group's performance continued to accelerate under the Return-to-Baseline condition, although the degree of acceleration was slowed. The percent change from Baseline to

Reinforcement was 41%, while the percent change from Reinforcement to Return-to-Baseline was 9%. However, on the Unique Task the group's performance dramatically decelerated under the Return-to-Baseline condition, with the children receiving their lowest scores under this condition. The percent change from Baseline to Reinforcement was 28%, while the percent change from Reinforcement to Return-to-Baseline was -48%. This greater effect obtained under the Return-to-Baseline condition on the Unique Task was probably an artifact of the high performance obtained under the Baseline condition. Further, the high Baseline performance might reflect the effects of novel stimulus on learning. Several other studies have found that the greatest performance was obtained on initial trials regardless of the reinforcement contingencies in effect (Mattson & Sage, 1965; Zeaman, House, & Orlando, 1958).

Although the effects of the Return-to-Baseline condition were more dramatic on the Unique Task, a deceleration in the performance on both tasks followed the removal of experimental reinforcement in this condition. This finding would be expected since the withdrawal of positive reinforcement does function as punishment in reducing performance rates. Another explanation of this result is apparent with a closer examination of the differences between the Unique Task and the Standard Task. The Unique Task, presenting new items under each condition, represents essentially an acquisition task because the children were required to learn new material. The subjects' behavior of "reading words" in the Unique Task was therefore weak in that the learning trials on this task were few (i.e., five trials for each set

of words). The Standard Task, on the other hand, required behavioral responses already within the behavioral repertoire of the subjects. Because they had received many learning trials (i.e., two and one-half years), the response of reading English words was established at a relatively high strength and thus much less likely to be dramatically altered as a function of the withdrawal of experimentally manipulated reinforcement.

In summary, significant differences were found across the three experimental conditions on both the Standard Task and the Unique Task. Further, the experimental group (N = 22) showed increased performance on both tasks under the Reinforcement condition. Under the Return-to-Baseline condition, the performance of the experimental group (N = 22) continued to accelerate but to a lesser degree on the Standard Task while dramatically decreasing on the Unique Task. Thus, the introduction of a Reinforcement procedure did produce significant increases in academic performance in a regular classroom setting.

Insert Figure 9 about here

A measure of retention was obtained for the Unique Task for the three experimental conditions. As is apparent from Figure 9, the degree of retention is directly related to performance in the acquisition period of each condition. The subjects received their highest scores on the retention measure for material learned under the reinforcing condition, while their lowest retention scores were obtained for material learned in the Return-to-Baseline condition. Retention was included as

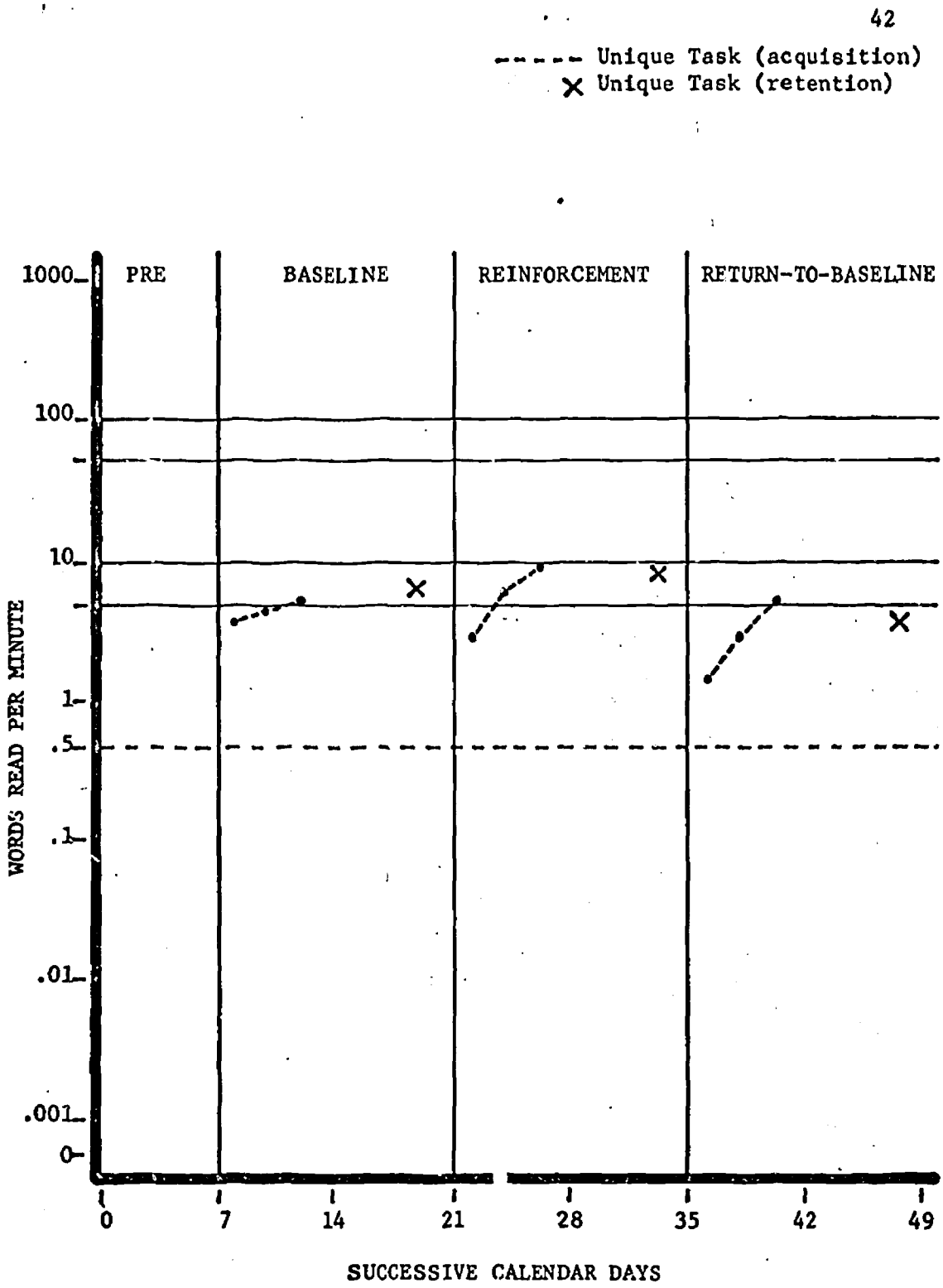


Fig. 9. Median scores of the 22 subjects on the Unique Task.

an element of this study to ascertain the validity of the notion that, when children are performing to obtain a "reward," they will forget what has been learned as soon as the reward has been obtained. This notion did not gain support by the data collected in this study.

Applicability of Procedures to Regular Classroom Academic Learning

The question that is generally raised concerning the application of reinforcement theory to regular classroom academic learning is not whether reinforcement is effective, but whether simultaneous procedures may be applied to a large group of students by one individual--the teacher. Therefore, data were collected on the question of teacher and specialist time involved in this study.

Insert Table 4 about here

The data in Table 4 covers only the Baseline and Reinforcement conditions because a teacher implementing reinforcement procedures would be unlikely to test a Return-to-Baseline condition. The regular classroom teacher assumed almost complete responsibility in that 61% of the actual implementation was carried out by her.

The amount of teacher and pupil time taken in this study was greatly increased by the Unique Task, since it required implementation of procedures for two different "reading" tasks--a situation unlikely to occur in a regular classroom. Procedures that could further decrease the expense in both time and money are discussed in the section Implications and Limitations.

TABLE 4

Time Spent in Phases I and II (Baseline and Reinforcement)

Task	Teacher	Observer	Experimenter	Total
Teaching	2.00 hours			2.00 hours
Data Collection	18.00 hours	8.00 hours		26.00 hours
Token Administration	.25 hours	.25 hours		.50 hours
Store Operation	.50 hours			.50 hours
Supervision			5 hours	5.00 hours
Total hours	20.75 hours	8.25 hours	5 hours	34.00 hours
% of total	61%	24.25%	14.75%	

Differential Effects of Reinforcement as a Function of Baseline Performance and of IQ

Only those subjects whose Baseline performance or IQ fell in the lower and upper quartiles were used in this analysis. The analysis by quartiles was carried out to determine whether the reinforcement procedures used in this study produced different effects on the performance of the subjects making up the extremes of the experimental population.

Baseline Performance

Insert Table 5 about here

The Kruskal-Wallis (one by three) Analyses of Variance (Siegel, 1956) across conditions produced significant findings for only the groups selected on low Baseline performance on the Standard Task and the Unique Task (Table 5). The findings on the groups selected on high Baseline performance did not approach significance.

The findings related to subjects selected on Baseline performance are consistent with reinforcement theory. It is assumed that the behavior of subjects who displayed high initial performance was already under the control of reinforcement other than that directly manipulated in the study (i.e., history of reinforcement for being successful). The subjects displaying low Baseline performance, however, were not as greatly affected by extra-experimental reinforcement and thus made significant increases under the Reinforcement condition. This explanation gains further support when the performance of the low Baseline subjects across all three conditions on each task is examined (Figure 10).

TABLE 5

Results of Eight Analyses of Variance Computed Across the Three Experimental Conditions for Subjects Selected on Baseline Performance and IQ

Unique Task		
N	Selection	H
5	low baseline performance	11.28*
5	high baseline performance	2.59
5	lower IQ	1.82
5	upper IQ	1.82

Standard Task		
N	Selection	H
5	low baseline performance	8.54*
5	high baseline performance	3.62
5	lower IQ	3.56
5	upper IQ	1.68

*$p < .01$

Insert Figure 10 about here

On the Unique Task, the effects appear more dramatic than on the Standard Task. The performance of the low Baseline subjects increased in the Reinforcement condition and dropped to a zero level under the Return-to-Baseline condition, indicating that performance was under control of the experimentally manipulated reinforcement. The same results were obtained for the Standard Task but are less apparent from inspection of the graph. However, if one looks at the percent change between conditions, the results are more readily apparent. The subjects selected on low Baseline performance on the Standard Task show considerably more gain from Baseline to Reinforcement than from Reinforcement to Return-to-Baseline. The percent change from Baseline to Reinforcement was 41%, while the percent change from Reinforcement to Return-to-Baseline was 16%.

The data for the subjects selected on high Baseline performance (Figure 11) show much less effect of the experimentally manipulated conditions. The relatively smaller gains made by the subjects selected on high Baseline performance may be due to asymtotic function of performance on these tasks. In other words, the high Baseline performance subjects may be reaching an optimal or ceiling level of performance, making higher performance impossible. Although this is a possible explanation, data is available (Starlin, 1970) which shows that children of this age are able to read orally at rates in excess of 150 words per minute. In fact, Starlin found that children

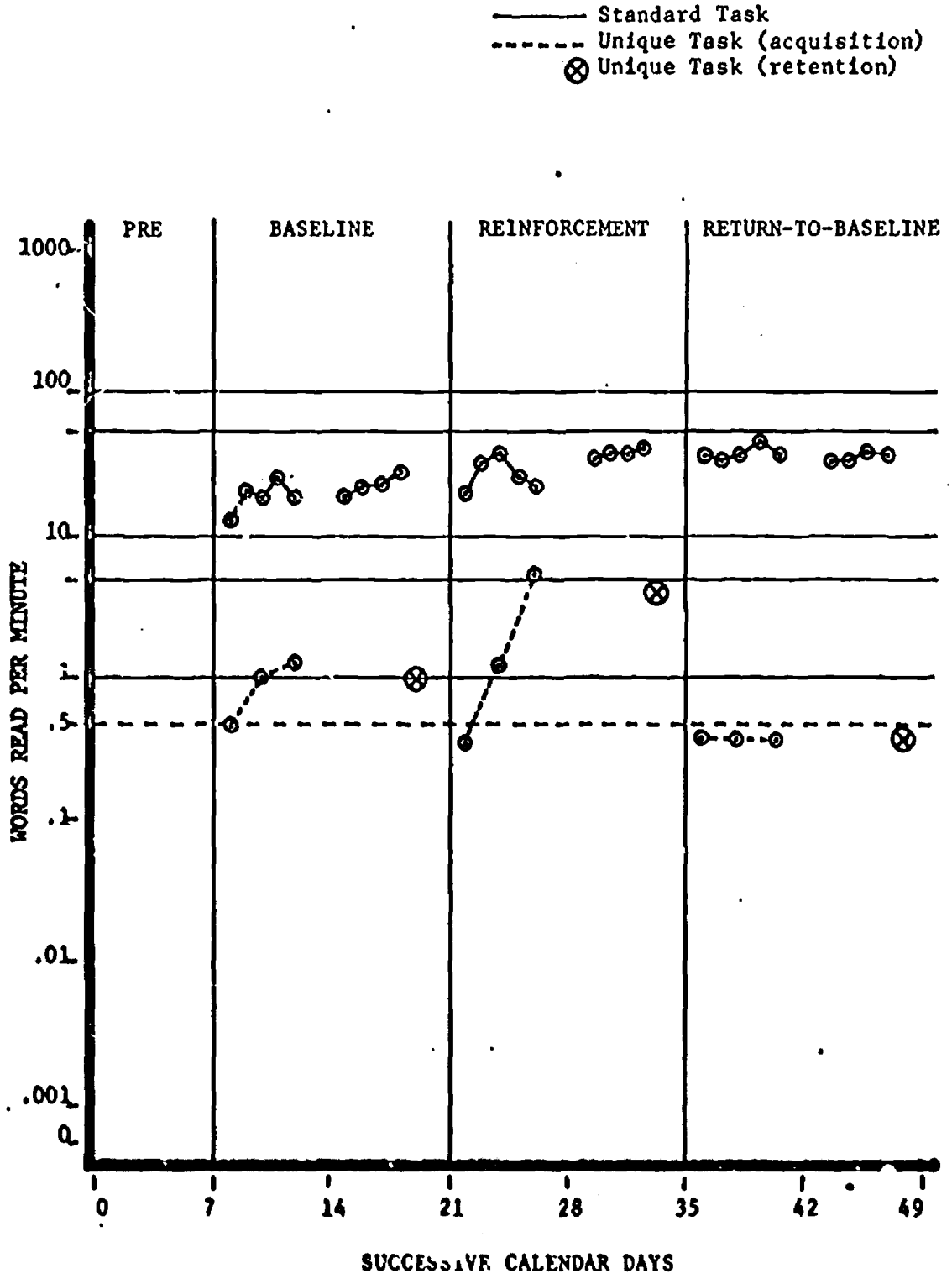


Fig. 10. Median scores of five subjects selected on low Baseline performance on the Standard Task and five subjects selected on low Baseline performance on the Unique Task.

ing less than 50 words per minute had a much more difficult time increasing rate than did those reading above this level.

Insert Figure 11 about here

The only effect that shows up clearly is that performance of subjects with high Baseline performance decreased on the Unique Task under the Return-to-Baseline condition. It is interesting to note that, while the performance on the Standard Task for these subjects did not increase significantly as a function of reinforcement, their performance across the duration of the study shows an increase from a median reading rate in Baseline of 92.5 words per minute to 114 words per minute in Return-to-Baseline.

Insert Figure 12 about here

Figure 12 shows the performance of the low and high Baseline groups on both the Standard Task and the Unique Task. Here it can be seen that the trends for both groups and tasks are similar with the low Baseline groups and Unique Task showing the greatest effects.

Insert Figure 13 about here

Retention on the Unique Task was also examined as a function of Baseline performance. As is apparent from Figure 13, retention appears to relate directly to acquisition. The retention scores of the high Baseline group appears slightly greater than that of the low Baseline group relative to their acquisition scores. The high Baseline group

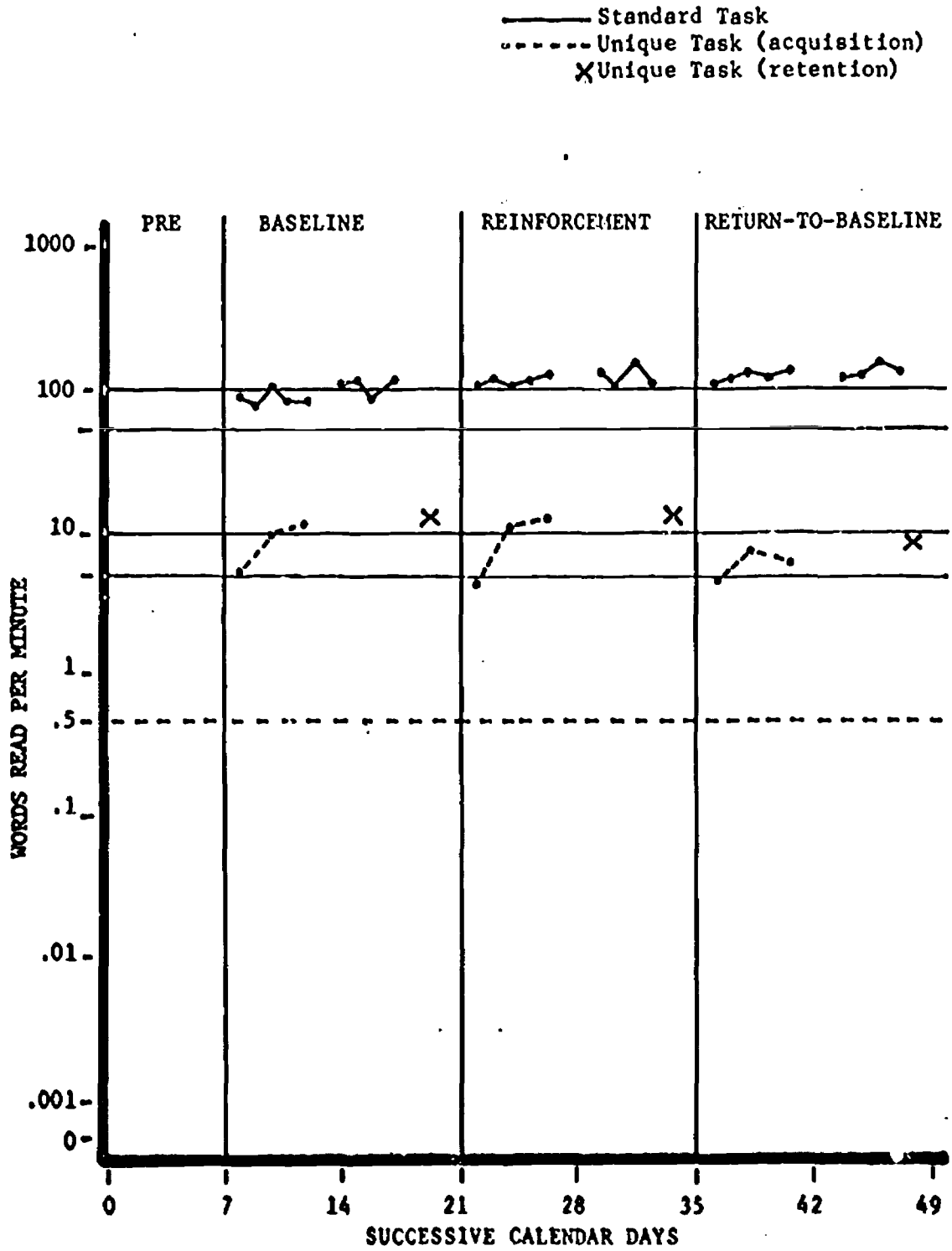


Fig. 11. Median scores of five subjects selected on high Baseline performance on the Standard Task and five subjects selected on high Baseline performance on the Unique Task.

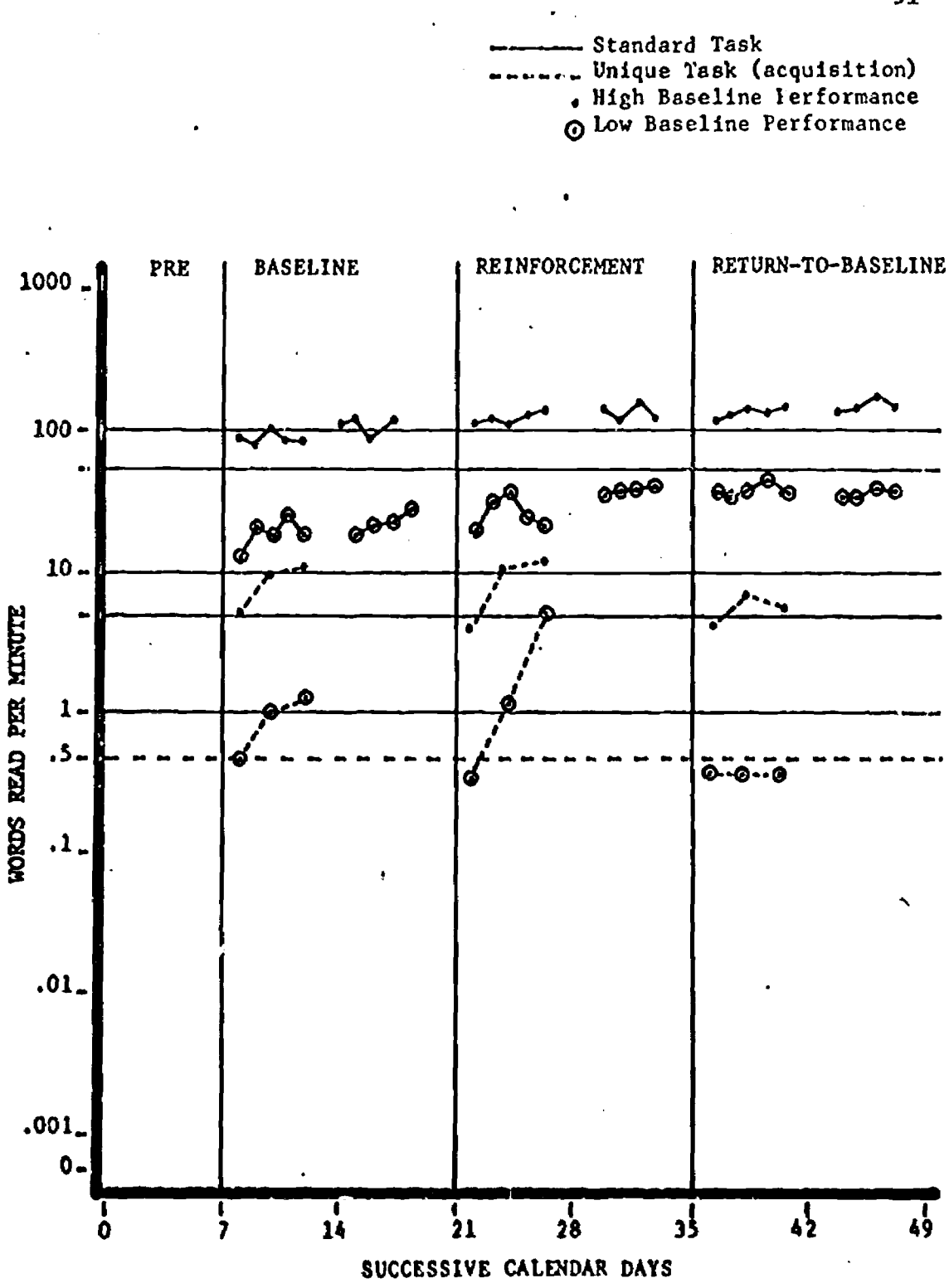


Fig. 12. Median scores of subjects selected by Baseline performance on the Standard Task and on the Unique Task.

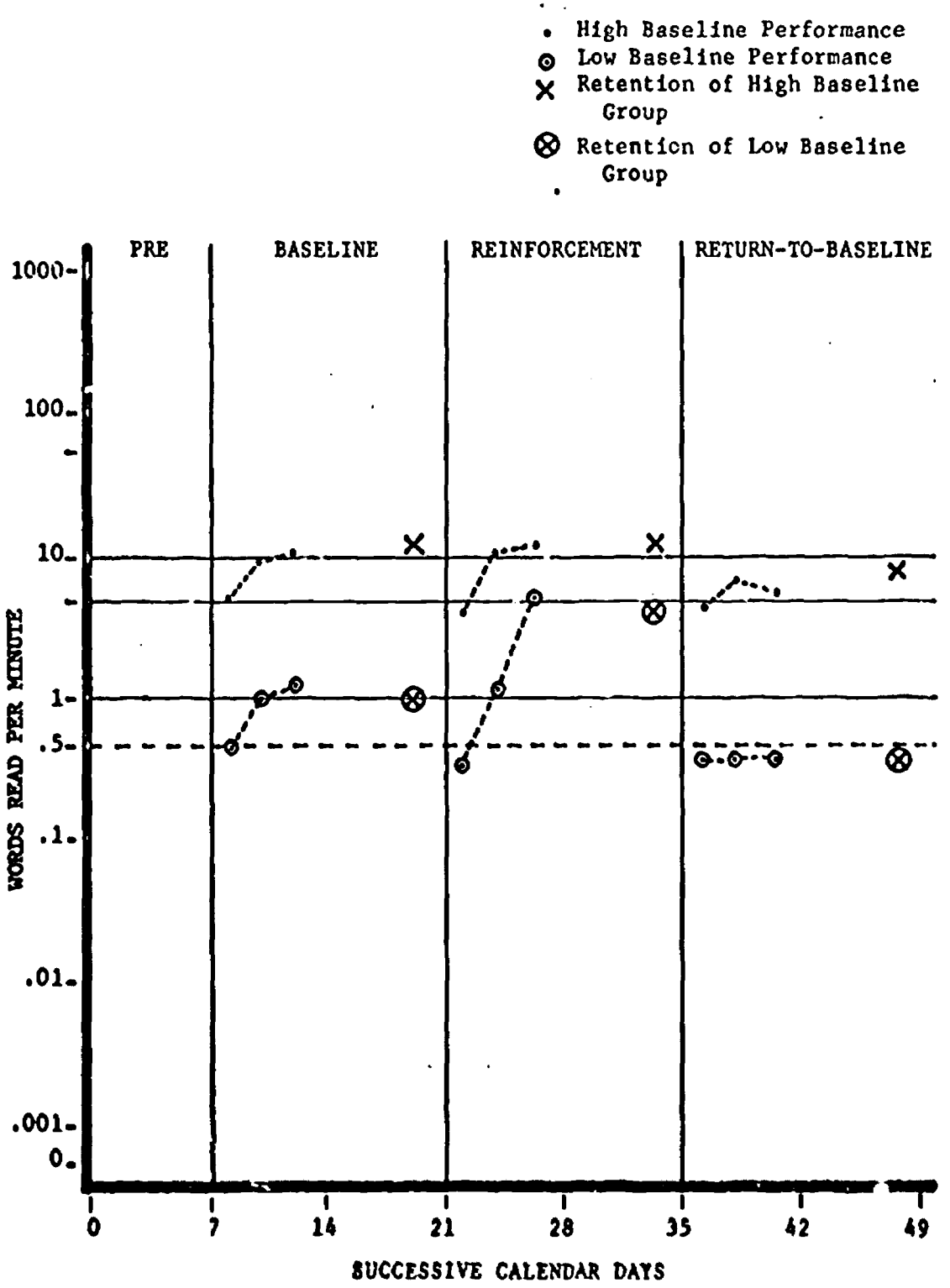


Fig. 13. Median scores of the five subjects selected on high Baseline performance and the five subjects selected on low Baseline performance on the Unique Task.

performed slightly higher on retention than acquisition while for the low Baseline group the opposite trend holds. One possible explanation for this finding is that the high Baseline group experienced over-learning on the task. This interpretation is supported by the data, in that the performance of the high Baseline group consistently flattens between the second and third data points in the acquisition period. This flattening trend is not apparent in the performance of the low Baseline group, which indicates that they were still working to gain mastery over the material.

In summary, the behavior of the subjects selected on low Baseline performance accelerated significantly under the Reinforcement condition while the behavior of subjects selected on high Baseline performance did not make significant increases. This finding along with the finding that the high Baseline performance group was not adversely affected by the procedures has far-reaching implications for classroom instruction.

IQ

Insert Table 6 about here

As the Kruskal-Wallis (one by three) Analyses of Variance shows (Table 6), there were no significant effects on performance that could be related directly to IQ levels. This might be due to the fact that the obtained IQ's within such a small experimental group (N = 22) did not yield the extreme scores necessary for contrast comparisons.

TABLE 6 .

Analyses of Variance Computed across the Three Experimental Conditions for Subjects Selected on the Basis of Low and High IQ Scores

Unique Task		
N	Selection	H
5	lower IQ	1.82
5	upper IQ	1.82

Standard Task		
N	Selection	H
5	lower IQ	3.56
5	upper IQ	1.68

Sig. .01 = 7.98

The upper quartile (N = 5) had an IQ range of 110 to 129, while the lower quartile (N = 5) had an IQ range of 74 to 88. Although these are not extreme scores, they are probably representative of the range likely to be found in a regular third grade classroom.

Although no significant effects on performance could be related directly to IQ levels, some tendencies or trends can be seen by closer examination of the data.

Insert Figure 14 about here

On the Unique Task, the upper IQ group appeared to be more affected by the experimental procedures than the lower IQ group. As is apparent from Figure 14, the performance of the upper IQ quartile was highest under the Reinforcement condition and actually decelerated across the Return-to-Baseline condition. Spearman Rank Order Correlations computed for the entire experimental group (N = 22) confirmed these findings. The correlation between IQ and Baseline performance on the Unique Task revealed a slight negative relationship ($r = -.33$), while the correlation between IQ and percent gain under Reinforcement yielded a positive result ($r = .53$).

The findings on retention on the Unique Task relative to IQ were consistent with those reported for the entire experimental group. As is seen from Figure 14, retention performance was directly related to performance during the acquisition period.

On the Standard Task, the findings for IQ parallel those found for low and high Baseline groups, but are less significant.

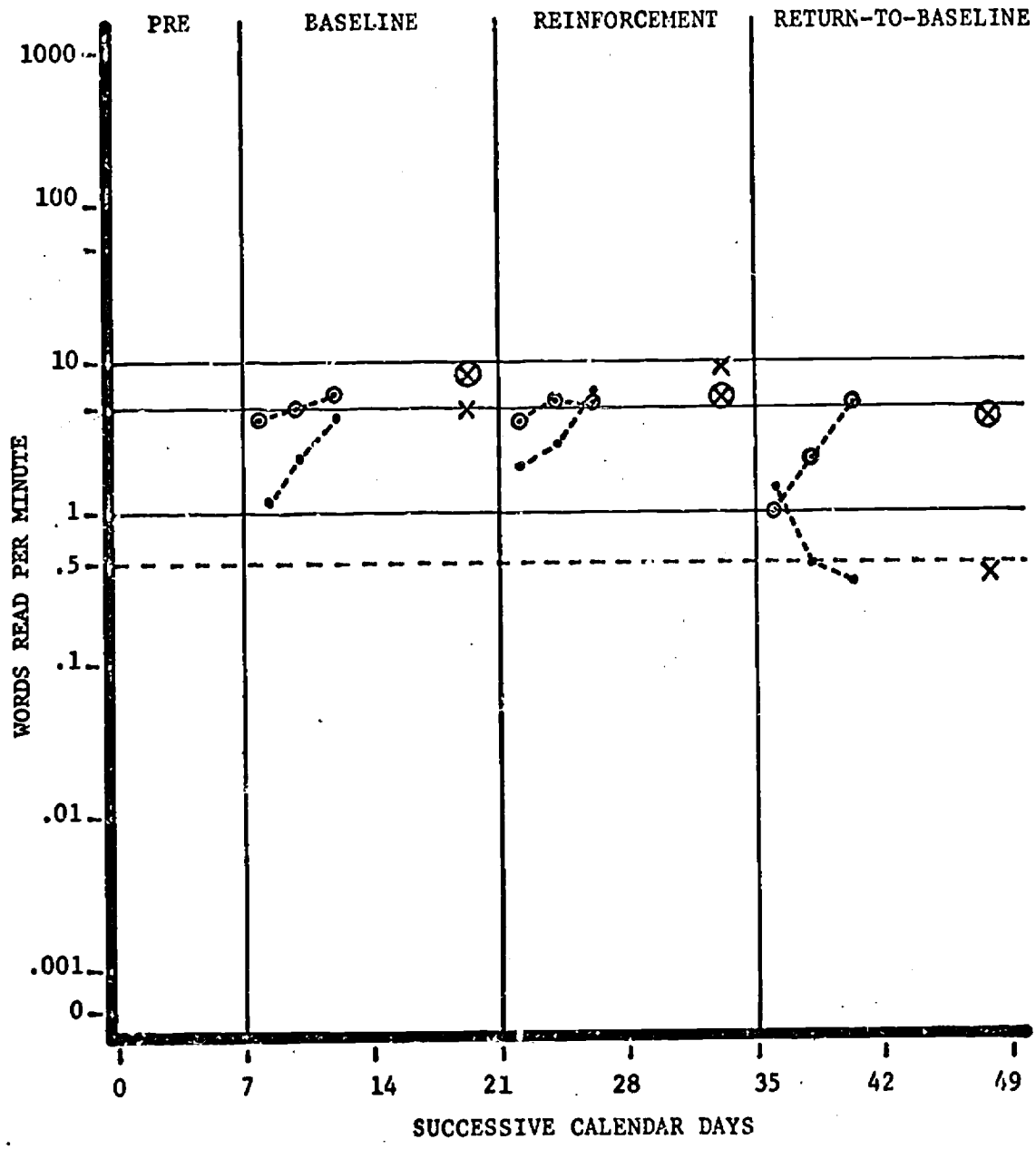


Fig. 14. Median scores on Unique Task of five subjects selected by upper IQ and five subjects selected by lower IQ.

Insert Figure 15 about here

As is apparent from inspection of Figure 15, performance of subjects selected on upper IQ began highest and held their position across all experimental conditions. The lower IQ group, however, yielded the greatest relative gains under the Reinforcement condition. The upper IQ group produced a 33% performance gain from Baseline to Reinforcement, while the acceleration for the lower IQ group across the same conditions was 50%.

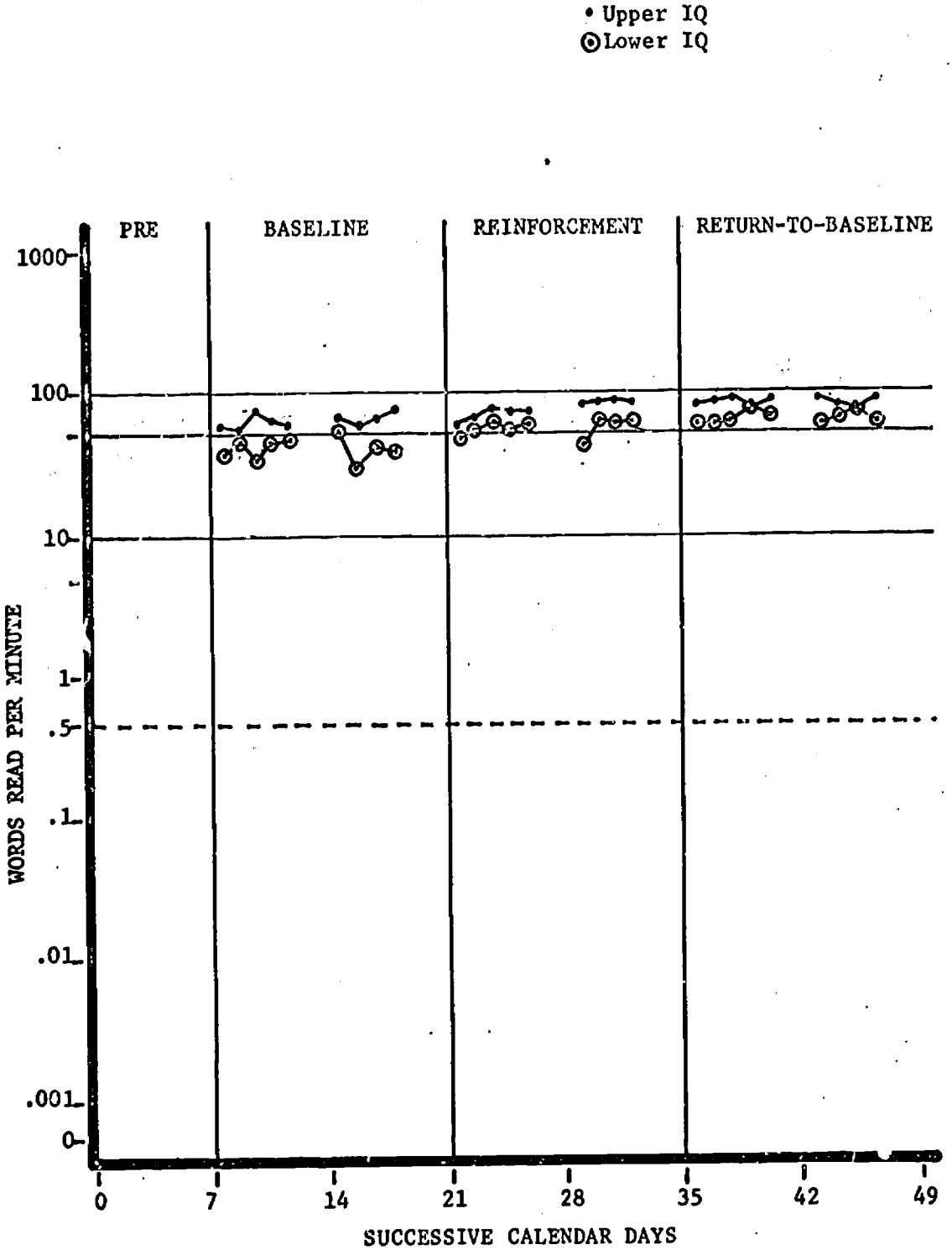


Fig. 15. Median scores on Standard Task of five subjects selected by upper IQ and of five subjects selected by low IQ.

CHAPTER FOUR

IMPLICATIONS AND LIMITATIONS

Classroom Instructional Implications

Reinforcement

In this study the introduction of a token reinforcement system in a regular classroom produced significant acceleration (i.e., increases) in the performance of the subjects across both of the experimental tasks. Several differential effects were found that indicated that, although the token reinforcement system did increase the performance of the entire classroom, several sub-groups within the classroom were more affected than others. The fact that the performance of the low Baseline group was accelerated more by the procedures than the other groups has direct implications for classroom instruction in that this group represents the children who are difficult to "motivate" or to manage and who typically learn at a much slower rate than that of their peers. These are the children for whom we must design remedial programs and with whom the teacher spends large amounts of time re-explaining instructions and helping at various phases in learning any task, whether simple or complex. That reinforcement procedures differentially increased this group's performance indicates that these children may be functioning more from a motivational deficit rather than any type of psychological, intellectual, or physical deficit.

Comments often made by teachers include the following:

"How can I motivate Johnny?"

"Johnny and Susie just don't seem to be able to keep up with the classroom."

"They don't seem to want to work; they don't seem to be interested in what is going on."

Every classroom has a group of children who do not seem to be motivated and who do not seem to be "turned on" by the educational enterprise or the materials used in the classroom. By using supplemental reinforcers (i.e., accelerating consequences), it may be possible to maximize the learning potential or performance of this group of children while at the same time increasing the performance of the rest of the group.

Although a highly extrinsic reinforcement system (token economy) was used in the present study, it was probably unnecessary. A system that could be more easily managed and much less expensively operated could be established in a regular classroom setting. Several attempts have been made by the author as well as others to identify reinforcers that were part of the curriculum or extra-curricular activities in the regular classroom. The reinforcers might include extra recess, field trips, parties, etc. (Homme, Csanji, Gonzales, & Rechs, 1969).

Another reinforcer might be a high interest corner where the children would spend time that they had earned by accelerating academic achievement. The interest corner should include a wide variety of materials, both academic and non-academic, in order to maximize the

reinforcement potential of such an area. The materials might include an easel for painting, a tape recorder both for listening to pre-recorded tapes of stories or music or for talking or reading into by the children, and a record player for which the children could bring records from home or get records from the library. A number of smaller items that could be obtained in the community or from educational resources would include such things as puzzles, games, high interest books, and scientific equipment such as microscope, wire, batteries, bulbs, switches, etc. The choice of objects would depend upon the grade level of the children for whom the area was designed. With younger children, for example, it may be made more into a play area and include trucks, blocks, doll house, doll clothes, dress-up clothes, finger paints, etc., while with older children in upper elementary or even junior high school, it may be made up of materials that would be of more interest to them and include an old lawn mower for disassembling, cleaning, and reassembling, or a project on which the class could be working together in teams such as building a go-cart or a soap-box derby or working on an academic area such as making a map of the world. There is no way to make a priori judgement as to what materials should be put in a high interest corner; but, by having a wide variety of materials available, one is maximizing the potential that all of the children will find something that will function as an accelerating consequence.

Data Collection

In light of the large amount of teacher time that was necessary to collect data in this study, one might ask about the feasibility of data

collection systems within a classroom where the teacher is already overworked. This author, as well as others (Haughton, 1969; Lindsley, 1964) believe that a data collection system is probably the single most important aspect of any classroom learning situation. It is absolutely necessary to have a means by which the students' ongoing educational performance can be evaluated at frequent points. This is necessary due to the individual differences that are found in every classroom.

In the present study, the performance of two of the subjects on the Unique Task across experimental conditions was opposite that of the remaining 20 subjects.

Insert Figure 16 about here

As can be seen from Figure 16, the experimentally manipulated reinforcement did not function as an accelerating consequence for these pupils. Because of the individual differences between children that occur in every classroom, data collection procedures must be used to frequently provide the teacher with information that will allow for the individual tailoring of accelerating consequences. Ideally, this data would be collected daily across a wide variety of academic behaviors.

Reading, the area used in this study, probably represents the area which will take the most time in terms of data collection, since reading must be done orally and someone must listen to the children read and mark down errors and correct, as well as time the child for a specific period. There are several techniques that can be used to reduce the teacher time necessary for this task.

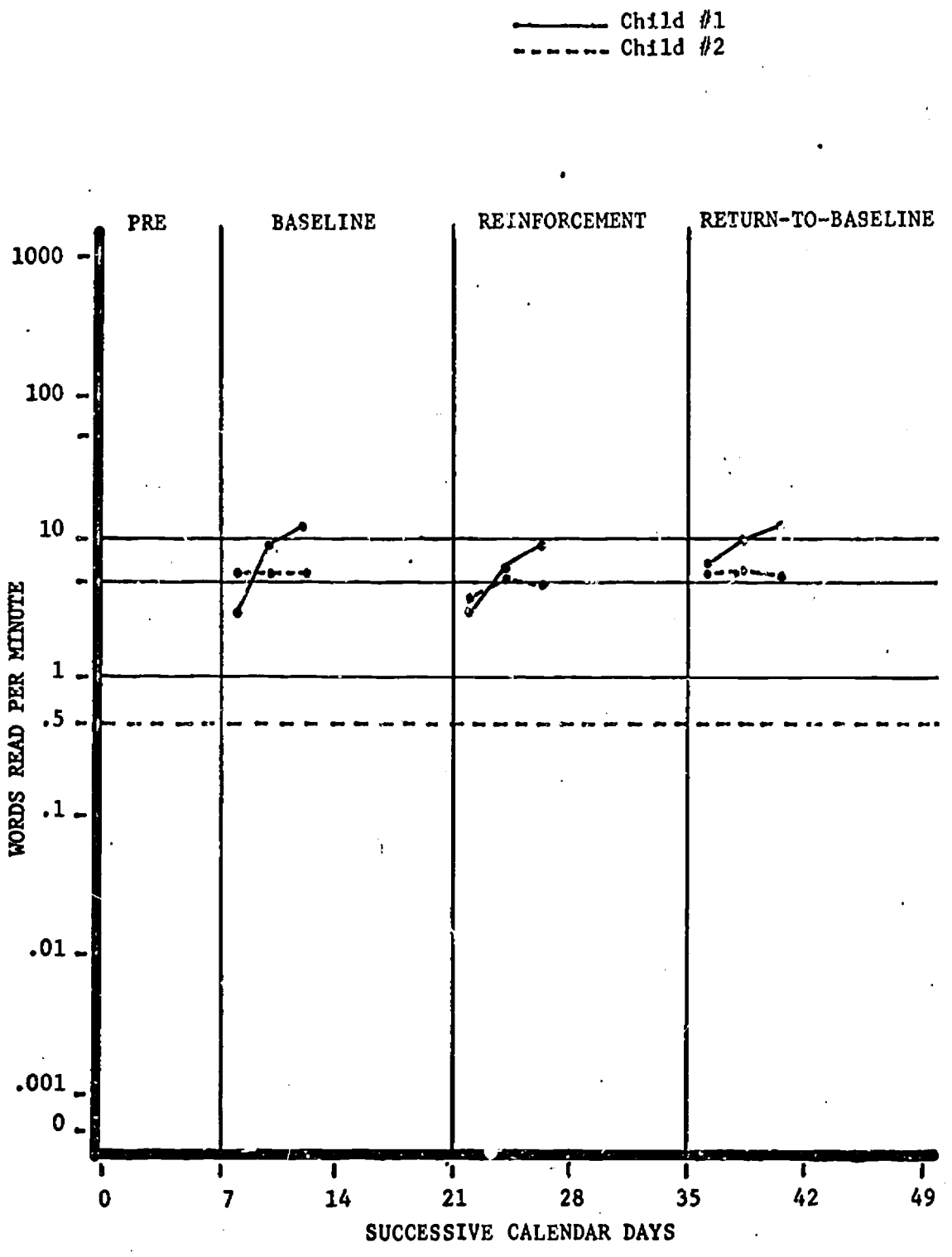


Fig. 16. Two subjects whose performance was decelerated by the Reinforcement condition.

The author is presently engaged in collecting reading data in the lower elementary grades, one through three, and is using upper grade pupils, fifth- and sixth-graders, who have been trained in the data collecting and recording procedures, thus limiting the time the teacher must spend in direct data collection and recording. Within this system, the upper grade pupils present to the teacher the error rate and correct rate of each pupil in the classroom along with the type of errors that the pupil is making, thus giving the teacher daily feedback information that will allow her to adjust the instructional curriculum to meet individual differences. Educational grouping for instruction then becomes a function of what types of errors the pupils are making and instruction is carried out on this basis. Another procedure for data recording that has been tried with some success is the use of a tape recorder with either a voice-activated microphone or a foot pedal wherein the child can just read into the tape recorder and the data can be analyzed at some later time for correct and error rates and then be charted.

In other areas, such as spelling, arithmetic, English, grammar, and writing, a permanent record is made by the child in terms of answering the questions or responding to the materials. For example, in the case of addition facts or multiplication facts or working division problems, if the children are given the problems to work daily and a specific time period in which to do them, then the papers can be graded at a later time and the results charted. This eliminates the need to use class time for the analysis of correct and errors and for charting.

Across all these activities a wide variety of agents are

available in the community who can help the teacher in administering and carrying out such a program. Such agents would include teacher aides, parent volunteers, older pupils, same-age peers, and members of the high school future teacher corps.

The targets of the procedures can vary widely from reduction of behavior problems to the acceleration of academic performances. Because the classroom's primary function is the acceleration of academic performance, it makes sense to focus on those targets. If a child has increased the amount of work that he is doing (i.e., has increased his academic performance), it is more than likely that the behavior problems, management or discipline problems, will be reduced simply as a function of more time being spent on academic work.

In summary, it is apparent that the application of reinforcement procedures to regular classroom learning environments is very feasible with the resources that are presently available to the regular classroom teacher.

Design Limitations and Implications

The present reseearch study had several limitations which should be considered when carrying out a study of this nature. First, the N that was used in this study was not randomly selected, restricting any generalizations that could be made about the effects of reinforcement on learning. In the sub-group analysis on Baseline performance and IQ, the N in each group was only five; with such a limited sample it is difficult to tell whether or not the effects that were obtained in this study

are valid or replicable.

The major limitation of this study was that the conditions of Baseline, Reinforcement, and Return-to-Baseline were in effect for very short periods of time. Each condition was in effect for a period of five to 10 school days. Because of this, the subjects' performance on neither task had the opportunity to stabilize under any condition before experimental conditions were switched. In conducting future research, the study should be designed so that the switching of conditions could be done as a function of the stabilization of the data rather than as a function of time. This is very difficult to do in a regular classroom setting where there are so many other variables that confound the experimenter's design problems. There are many problems of a calendar or time nature because the children have a variety of vacations that differ in length. Also, children are constantly changing classrooms and moving within the curriculum across a wide variety of areas including music, physical education, foreign languages, etc., which makes it very difficult to find an experimental block of time which can be used consistently over a long period of time.

Another problem encountered in this study was that the Unique Task, to get at problems of acquisition, changed in content across the three experimental conditions. Because of this, it is very difficult to ascertain whether or not the experimental results obtained were a function of the experimental conditions or a function of the change in the task. It might be more feasible to look at an on-going task in a regular classroom where the elements were added, such as in initial

reading instruction at the first grade level where sound-symbol associations and blending are taught and new elements are continually being added to the child's repertoire. In a design of this type it may be possible to see any differences that might occur in terms of the ability to learn new sequences of material under various conditions. A study is presently underway by the author in examining the process of learning to read in 60 first-grade youngsters. It is hoped that this may offer a further basis for research designs of this type within a regular classroom setting where the experimental variables are not manipulated in such a manner that they make applicability to classroom instruction nearly impossible.

Another shortcoming of this study was that, on the Unique Task in the Return-to-Baseline condition, the reinforcement was just removed. Although there was a deceleration in the performance rates of the subjects under this condition, it probably would have been a better design if it had incorporated an actual reversal procedure wherein the subjects were reinforced contingent upon time, rather than contingent upon the production of correct responses. This would demonstrate more clearly the effects of contingent reinforcement on the production of correct responses.

CHAPTER FIVE

SUMMARY

The present study was designed to investigate the effects of a token reinforcement system on the academic performance of a regular third-grade classroom (N = 22). Two performance tasks were used in this study. The first of these was oral reading from standard classroom materials while the second was a unique reading task designed to study acquisition and retention. The Unique Task was composed of a series of sound-symbol associations taught by the regular classroom teacher using a standard teaching lesson. The experimental design used subjects as their own controls on repeated measures across the three conditions of Baseline, Reinforcement, and Return-to-Baseline.

Data were collected in the form of oral reading rates for both tasks across the three experimental conditions. Both statistical and descriptive analyses were conducted on the data and presented.

The results obtained were consistent with those found in previous studies using reinforcement procedures in that the subjects' performance was significantly increased ($p < .05$) on both tasks under the reinforcing condition. The Return-to-Baseline condition produced differential effects as a function of tasks. The performance on the unique learning task decelerated dramatically, while the performance on the standard reading task continued to accelerate. This result was

considered to be an effect of the differences in reinforcement available in the extra-experimental environment for the two tasks. There were no differences found in retention across the conditions after retention scores were corrected for acquisition. Results were then examined as a function of IQ and Baseline performance, with the low Baseline group being the only subgroup to produce significant performance changes ($p < .01$) across conditions. Trends were apparent in the data analyzed for IQ, which seems to indicate that the upper IQ group was more responsive to the experimentally manipulated reinforcement. Although this study was limited by non-random selection of subjects and time period involved, implications for classroom instruction and further research were suggested.

BIBLIOGRAPHY

Ayllon, T. & Azrin, N. H. Reinforcer sampling: A technique for increasing the behavior of mental patients. Journal of Applied Behavior Analysis, 1968, 1, 13-20. (a)

Ayllon, T. & Azrin, N. H. The token economy: A motivational system for research and rehabilitation. New York: Appleton-Century-Crofts, 1968. (b)

Allen, K. E. & Harris, F. R. Elimination of a child's excessive scratching by training the mother in reinforcement procedures. Behavior Research and Therapy, 1966, 4, 79-84.

Allen, K., Hart, B. M., Joan, S., Harris, R., & Wolf, M. M. Effects of social reinforcement on isolate behavior of a nursery school child. Child Development, 1964, 35, 511-518.

Baer, D. M. Laboratory control of thumbsucking by withdrawal and representation of reinforcement. Journal of the Experimental Analysis of Behavior, 1962, 5, 525-528.

Bateman, B. D. & Schiefelbusch, R. Educational identification, assessment, and evaluation procedures. In N. Haring (Ed.), Report of the education subcommittee of Task Force II on children with learning disabilities. (In press)

Becker, W. C., Madsen, C. H, Arnold, R., & Thomas, D. R. The contingent use of teacher attention and praise in reducing classroom behavior problems. Journal of Special Education, 1967, 1, 287-307.

Bijou, S. W. & Baer, D. M. Operant methods in child behavior development. In W. Honig (Ed.), Operant behavior: Areas of research and application. New York: Appleton-Century-Crofts, 1966.

Bijou, S. W. & Sturges, P. T. Positive reinforcers for experimental studies with children--consumables and manipulables. Child Development, 1959, 3, 151-170.

Birnbrauer, J. S., Wolf, M. M., Kidder, J. D., & Tague, C. Classroom behavior of retarded pupils with token reinforcement. Journal of Experimental Child Psychology, 1965, 2, 219-235.

Brown, P. & Elliot, R. Control of aggression in a nursery school class. Journal of Experimental Child Psychology, 1965, 2. 103-107.

Buchanan, C. L. Sullivan program reading series. Revised Edition. New York: McGraw-Hill, 1968.

DeCecco, J. P. The psychology of learning and instruction: Educational psychology. New Jersey: Prentice-Hall, 1968.

Dykstra, R. Summary of the second-grade phase of the cooperative research program in primary reading instruction. Reading Research Quarterly, 1968, 4, 49-70.

Estes, W. K. Learning. In Encyclopedia of educational research. Third Edition. New York: Macmillan, 1960. Pp. 752-767.

Evans, R. I. B. F. Skinner: The man and his ideas. New York: Dutton & Co., 1968.

Ferster, C. B. & Skinner, B. F. Schedules of reinforcement. New York: Appleton-Century-Crofts, 1957.

Fitzsimmons, S. J., Cheever, J., Leonard E., & Macunovich, D. School failures: Now and tomorrow. Developmental Psychology, 1969, 1, 134-146.

Flanagan, B., Goldiamond, I., & Azrin, N. Operant stuttering: The control of stuttering behavior through response-contingent consequences. Journal of the Experimental Analysis of Behavior, 1958, 1, 173-177.

Gates, A. I. & MacGinitie, W. H. Gates-MacGinitie reading tests. New York: Columbia Teachers College Press, 1965.

Gurren, L. & Hughes, A. Intensive phonics vs. gradual phonics in beginning reading. A review. Journal of Educational Research, 1965, 58, 339-346.

Hall, R. V. & Broden, M. Behavior changes in brain-injured children through social reinforcement. Journal of Experimental Child Psychology, 1967, 5, 463-479.

Haring, N. G. & Hauck, M. A. Improved learning conditions in the establishment of reading skills with disabled readers. Exceptional Children, 1969, 35, 341-352.

Haring, N. G. & Kunzelmann, H. P. The finer focus of therapeutic behavioral management. In J. Hellmuth (Ed.), Educational therapy. Vol. 1. Seattle: Special Child Publications, 1966.

Harris, F. R., Johnston, M. K., Kelly, C. S., & Wolf, M. M. Effects of positive social reinforcement on regressed crawling of a nursery school child. Journal of Educational Psychology, 1964, 55, 35-41.

Haughton, E. Counting together: Precision teaching rationale--'69. Unpublished manuscript, University of Oregon, 1969.

Hewett, F. Teaching reading to an autistic boy through operant conditioning. Reading Teacher, 1964, 17, 613-618.

Hewett, F. M., Taylor, F. D., & Artuso, A. A. The Santa Monica project: Evaluation of an engineered classroom design with emotionally disturbed children. Exceptional Children, 1969, 35, 523-529.

Homme, L. E., Csanji, A. P., Gonzales, M. A., & Rechs, J. P. How to use contingency contracting in the classroom. Champaign, Ill.: Research Press, 1969.

Homme, L. E., deBaca, P., Devine, J. V., Steinhorst, R., & Rickert, E. J. Use of the Premack Principle in controlling the behavior of nursery school children. Journal of Experimental Analysis of Behavior, 1963, 6, 544.

Hotchkiss, J. The modification of maladaptive behavior of a class of educationally handicapped children by operant conditioning techniques. Unpublished doctoral dissertation, University of Southern California, 1966.

Karraker, R. J. Token reinforcement systems in regular public school classrooms. Paper presented at the meeting of the American Educational Research Association, Chicago, 1968.

Kirk, R. E. Experimental design: Procedures for the behavioral sciences. Belmont, Calif.: Wadsworth, 1968. Pp. 90-91.

Krasner, L. & Ullmann, L. P. (Eds.) Research in behavior modification. New York: Holt, Rinehart & Winston, 1965.

Lindsley, O. R. Direct measurement and prosthesis of retarded behavior. Journal of Education, 1964, 147, 62-81.

Lovaas, O. I. Control of food intake in children by reinforcement of relevant verbal behavior. Journal of Abnormal and Social Psychology, 1964, 68, 672-678.

Lovaas, O. & Simmons, J. O. Manipulation of self-destruction in three retarded children. Journal of Applied Behavior Analysis, 1969, 2, 143-157.

Mattson, R. H. & Sage, D. D. Reinforcing effects of differential contingencies on verbal learning in educable mentally retarded children. Eugene, Oregon: University of Oregon, 1965. Grant No. 32-47-0230-1008.

Millenson, J. R. Principles of behavioral analysis. New York: Macmillan, 1967. P. 245.

O'Leary, K. D. & Becker, W. C. Behavior modification of an adjustment class: A token reinforcement system. Exceptional Children, 1967, 33, 637-642.

O'Leary, K. D., Becker, W. C., Evans, M. B., & Sandargas, R. A. A token reinforcement program in a public school: A replication and systematic analysis. Journal of Applied Behavior Analysis, 1969, 2, 3-13.

Osborne, J. G. Free-time as a reinforcer in the management of classroom behavior. Journal of Applied Behavior Analysis, 1969, 2, 113-118.

Patterson, G. R. A learning theory approach to the treatment of the school phobic child. In L. Ullmann & L. Krasner (Eds.), Case studies in behavior modification. New York: Holt, Rinehart & Winston, 1965. Pp. 279-294.

Patterson, G. R., Ebner, M., & Shaw, D. A. Teachers, peers, and parents as agents of change in the classroom. In F. A. M. Benson (Ed.), Modifying deviant social behaviors in various classroom settings. Eugene, Oregon: University of Oregon, 1969, No. 1.

Quay, H. C., Werry, J. S., McQueen, M., & Sprague, R. L. Remediation of the conduct problem child in a special class setting. Exceptional children, 1966, 32, 509-515.

Reynolds, N. J. & Risley, T. R. The role of social and material reinforcers in increasing talking of a disadvantaged preschool child. Journal of Applied Behavior Analysis, 1968, 1, 253-262.

Risley, T. & Wolf, M. M. Establishing functional speech in echolalic children. Behavior Research and Therapy, 1967, 5, 73-88.

Schmidt, G. W. & Ulrich, R. E. Effects of group contingent events upon classroom noise. Journal of Applied Behavior Analysis, 1969, 2, 171-179.

Siegel, S. Nonparametric statistics. New York: McGraw-Hill, 1956. Pp. 184-193.

Silberman, H. F. Reading and related verbal learning. In R. Glaser (Ed.), Teaching machines and programmed instruction. Vol. II. Washington, D. C.: National Education Association, 1965. Pp. 508-545.

Skinner, B. F. Rate as the datum. In W. K. Honig (Ed.), Operant behavior: Areas of research and application. New York: Appleton-Century-Crofts, 1966.

Skinner, B. F. Science and human behavior. New York: Macmillan, 1953.

Staats, A. W. & Butterfield, W. A. Treatment of nonreading in a culturally deprived juvenile delinquent: An application of reinforcement principles. Child Development, 1965, 36, 925-942.

Staats, A. W., Finley, J. R., Minke, K. A., & Wolf, M. Reinforcement variables in the control of unit reading responses. Journal of Experimental Analysis of Behavior, 1964, 7, 139-149.

Staats, A. W., Minke, K. A., Finley, J. R., Wolf, M. M., & Brooks, L. O. A reinforcement system and experimental procedure for the laboratory study of reading acquisition. Child Development, 1964, 35, 209-231.

Staats, A. W., Minke, K. A., Goodwin, W., & Landeen, J. Cognitive behavior modification: 'Motivated learning' reading treatment with sub-professional therapy technicians. Behavior Research and Therapy, 1967, 5, 283-299.

Staats, A. W., Staats, C. K., Schutz, R. E., & Wolf, M. M. The conditioning of textual responses using "extrinsic reinforcers." Journal of Experimental Analysis of Behavior, 1962, 5, 33-40.

[illegible], [illegible]. Evaluating progress towards reading efficiency. In B. Bateman (Ed.), Learning disorders. Volume IV. Seattle: Special Child Publications, 1970, in press.

Tyler, V. O., Jr. & Brown, G. D. Token reinforcement of academic performance with institutionalized delinquent boys. Journal of Educational Psychology, 1968, 59, 164-168.

Ullmann, L. P. & Krasner, L. (Eds.), Case studies in behavior modification. New York: Holt, Rinehart & Winston, 1965.

Walker, H. M. & Buckley, N. K. The use of positive reinforcement in conditioning attending behavior. Journal of Applied Behavior Analysis, 1968, 1, 245-250.

Walker, H. M., Mattson, R. H., & Buckley, N. K. Special class placement as a treatment alternative for deviant behavior in children. In F. A. M. Benson (Ed.), Modifying deviant social behaviors in various classroom settings. Eugene, Oregon: University of Oregon, 1969, No. 1.

Whitlock, C. & Bushell, D. Some effects of "back-up" reinforcers on reading behavior. Journal of Experimental Child Psychology, 1967, 5, 50-57.

Whitlock, C. Note on reading acquisition: An extension of laboratory principles. Journal of Experimental Child Psychology, 1966, 3, 83-85.

Williams, C. D. The elimination of tantrum behavior by extinction procedures. Journal of Abnormal and Social Psychology, 1959, 59, 269.

Winer, B. J. Statistical principles in experimental design. New York: McGraw-Hill, 1961. Pp. 105-113.

Wolf, M. M., Giles, D. K., & Hall, R. V. Experiments with token reinforcement in a remedial classroom. Behavior Research and Therapy, 1968, 6, 51-64.

Zeaman, D. A., House, B. J., & Orlando, R. Use of special training conditions in visual discrimination learning by imbeciles. American Journal of Mental Deficiency, 1958, LXIII, 453-459.

Zimmerman, E. H. & Zimmerman, J. The alteration of behavior in a special class situation. Journal of the Experimental Analysis of Behavior, 1962, 5, 59-60.

Zimmerman, E. H., Zimmerman, J., & Russell, C. D. Differential effects of token reinforcement on instruction-following-behavior in retarded students instructed as a group. Journal of Applied Behavior Analysis, 1969, 2, 101-112.

FOOTNOTES

1. The teacher, Mrs. Sally Schaefers, was an Experienced Teacher Fellow at the University of Oregon, 1967 to 1968.

2. "Acquisition" is defined as rate correct on criteria test immediately following daily teaching session.

3. "Retention" is defined as rate correct on criteria test seven days after final teaching session.

4. Six of the subjects had been tested by the regular school psychologist during the year in which this study was conducted and therefore these five IQ scores were obtained from school records.

5. Both correct rate and error rate were collected in this study. Corrected scores were then computed by subtracting error rate from correct rate for each subject. Because there were no differences in the rank orders between correct rate and corrected scores, correct rate was presented.

6. The composite data for the analysis of quartiles and graphing uses medians rather than means. Medians were selected because the median score is more representative of the typical performance of a child and is not affected by atypical extreme low and high scores. Rank-order correlations were computed between means and medians for this data with resultant r in the .90. The broken horizontal line on the graphs is referred to as the record floor and indicates where only one response is correct in the data collection period (two minutes). Any and all

data points below this line are to be interpreted as zero responses correct within the allotted time period.

APPENDIX A

STANDARDIZED TEACHING LESSON

π This letter says /a/. Now you say it.

What does this letter say?

Now write it, saying /a/ as you write it.

What does this say?

Everybody say it. /a/

Write it again. Say /a/ as you write it.

λ This letter says /m/. You say it.

What does this letter say?

Now write it. Say /m/ as you write it.

What does this letter say?

Write it again. Say /m/ as you write it.

What does this letter say?

Everybody say it.

π What does this letter say?

Everybody say it.

λπ Let's put them together. /ma/. You say it.

What does this say?

πλ What does this say?

Everybody say it. /am/

Now write /am/. Say it as you write it.

Write it again.

λπ Now write /ma/. Say it as you write it.

Write it again. /ma/

πλ What does this say?

Everybody say it.

λπ What does this say?

Everybody say it.

≡ This letter says /r/. Say it.

What does this letter say?

Now write it. Say it.

What does this say?

Write it again.

What does this letter say?

Everybody say it.

π What does this letter say?

≡π Let's put them together. What does this say?

Everybody say it. /ra/

ΞπΛ Try this. What does this say?

Everyone say it.

Now write it. /ram/

What does this say?

Λ This letter says /s/. You say it.

What does this letter say?

Now write it and say it.

What does this say?

Write it again. /s/

What does this say?

Everybody say it.

Λπ Now let's put them together. What does this say?

Everybody say it. /sa/

Try these next ones with me.

ΛπΛ /sam/

Everybody say it.

ΛπΛ /sas/

Everyone say it.

ΛπΛ /mas/

Everyone say it.

ΞπΛ /ras/

Everyone say it.

Now, I'll say the word and you write it and say it.

/sam/

/sas/

/mas/

/ras/

ΛπΛ Okay. What does this say?

ΛπΛ And this?

ΛπΛ And this?

ΞπΛ And this?

δ Now. This letter says /b/. You say it.

What does this say?

Write it and say it.

What does this say?

Write it again.

What does this say?

Everybody say it.

Now think hard. Tell me what these letters say as I hold them up.

π /a/

δ /b/

πδ /ab/

Everybody say it. /ab/

λπδ /mab/

Everyone say it.

Ξπδ /rab/

Everyone say it.

Λπδ /sab/

Everyone say it.

Now write them as I call them out.

/ab/

/mab/

/rab/

/sab/

δπ Okay. Let's read these. /ba/

Everyone say it.

δπλ /bam/

Everyone say it.

δπΛ /bas/

Everyone say it.

δΞπΛ /bras/

Everybody say it.

Now write these:

/ba/

/bam/

/bas/

/bras/

Say these as I hold them up.

π

πλ

Ξπλ

Λπλ

δπλ

λπ

λπλ

λπΛ

λπδ

Ξπ

ΞπΛ

Ξπδ

Λπ

ΛπΛ

Λπδ

δπ

δπδ

δπΛ

δΞπΛ

Academic Group Record

TRAINER _____ ADVISOR _____ MANAGER _____ LOCATION _____

Classroom _____ Movement Cycle _____

	Date:														
Name	# Cor	# Err	# Time	# Cor	# Err	# Time	# Cor	# Err	# Time	# Cor	# Err	# Time	# Cor	# Err	# Time
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															
21															
22															
23															
24															
25															

APPENDIX C

UNIQUE TASK DATA COLLECTION FORM

A, C				
4	27	50	73	96
9	32	55	78	101
12	35	58	81	104
14	37	60	83	106
19	42	65	88	111
23	46	69	92	115

B				
4	27	50	73	96
9	32	55	78	101
11	34	57	80	103
14	37	60	83	106
19	42	65	88	111
23	46	69	92	115

Name	WC	E	C	Total	Name	WC	E	C	Total

A, B, and C refer to list of "words" used.
The numbers in the above lists represent cumulative sounds total.
WC = Words correct
E = Errors (in sounds)
C = Correct (in sounds)
Total = Total no. of sounds read in 2 minutes

APPENDIX D

STORE ITEMS AND PRICES

5 tokens:	candy
	bubble gum
	balloons
15 tokens:	5 bubble soap
	9 bags small marbles
	4 balls and jacks
	3 me-ows
	2 water guns
	1 handcuffs
	5 small gliders
	2 triangle peg puzzles
	1 set bracelets
25 tokens:	4 bags large marbles
	2 regular jump ropes
	4 small horses
	2 large gliders
	4 paddles with balls
	2 checker games
	2 Chinese checkers
	1 bag colored loops
45 tokens:	1 small teaset
	1 juicer set
	2 banks
	2 jr. slinkeys
	3 Chinese jump ropes
	1 doodle-poodle
	4 10-minutes free time
	2 bracelet, necklace sets
	2 Japanese wood puzzles
	1 Grand Prix race maze
	1 magic puzzle
65 tokens:	2 oil paint sets
	1 pop gun
	1 magic putty
	2 regular yo-yo's
	1 gyroscope
	1 large teaset
	1 magic rocks
	4 15-minutes free time
	1 flying saucer and tops

85 tokens:	2 rockets 3 dartboards 1 gun and holster 1 broom 1 mop 1 gee-wee set 1 corvette 1 yo-yo 2 batons 6 models (Seaview, Space clipper, SST, Ford, Torino, midget racer, Warhawk) 1 arrow copter 1 pinball game
100 tokens:	2 large horses 1 stuffed goat 2 cavemen 1 dresser set 2 kiddles 6 hot wheels 3 balls and bats 5 pup tents 1 dart gun set 2 baking sets 1 carrom board 5 models (2 boats, Turban car, Star Trek, Race Car)

APPENDIX E

PRE-PHASE LESSON

u — This letter says /u/. Now you say it. /u/

What does this say?

Everybody say it. /u/

Now write it. Say /u/ as you write it.

What does this say?

n — This letter says /n/. You say it. /n/

What does this letter say?

Everybody say it. /n/

Now write it, saying /n/ as you write it.

What does this say?

un — Now let's put them togheter. /un/

Everybody say it. /un/

What does this say?

Now write it. Say it as you write it. /un/

What does this say?

nu — Try this one. What does this say?

What does this say?

Everybody say it?

p — This letter says /p/. You say it. /p/

What does this say?

p (cont.)

Everybody say it. /p/

Now write it. Say it as you write it.

What does this say?

up Let's put them together. What does this say?

Everybody say it.

Write it as you say it.

What does this say?

nup What does this say?

Everybody say it.

pu Try this. What does this say?

Everybody say it.

pun What does this say?

Everybody say it.

Now you write them as I call them out.

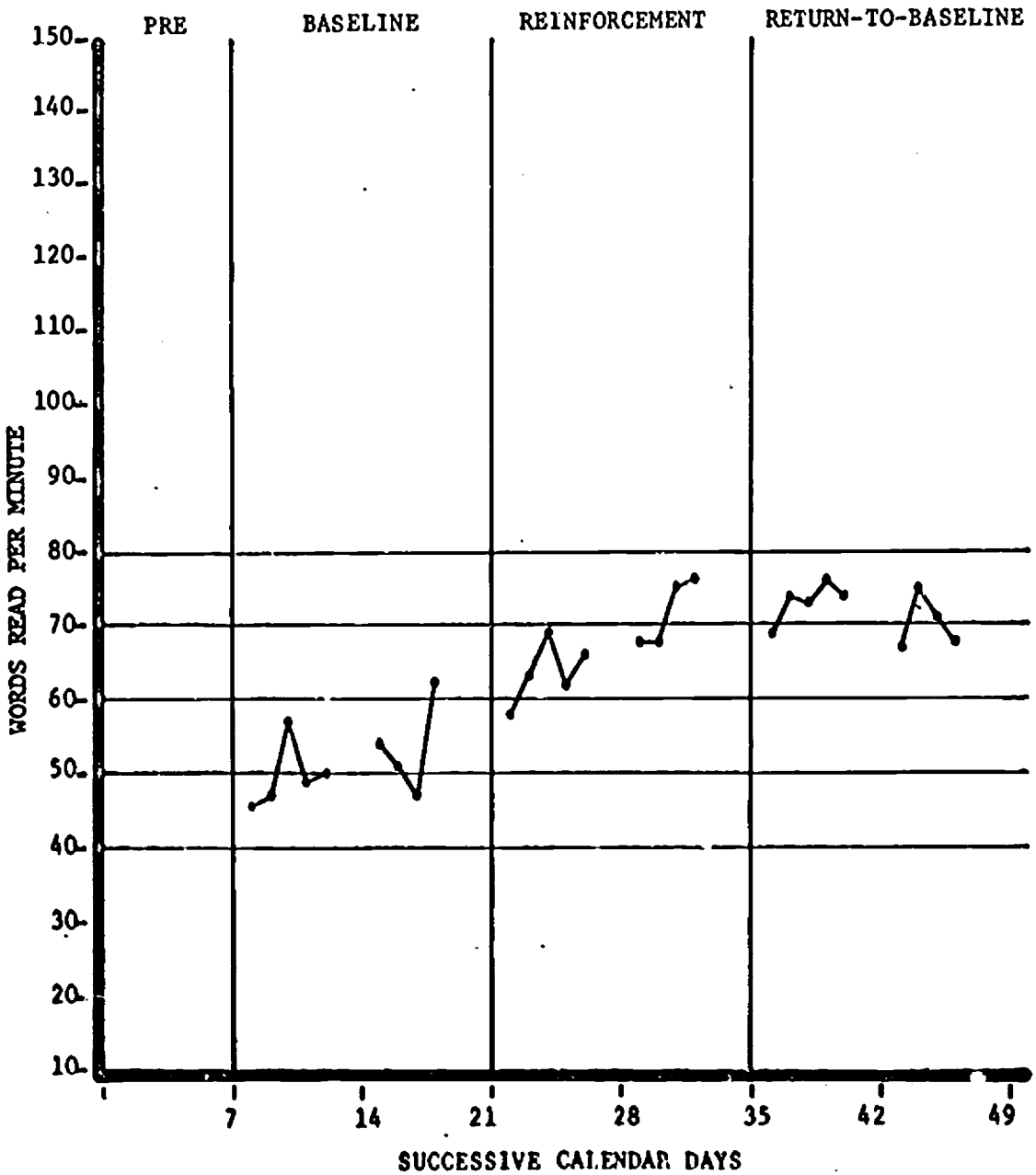
/un/

/pun/

/nup/

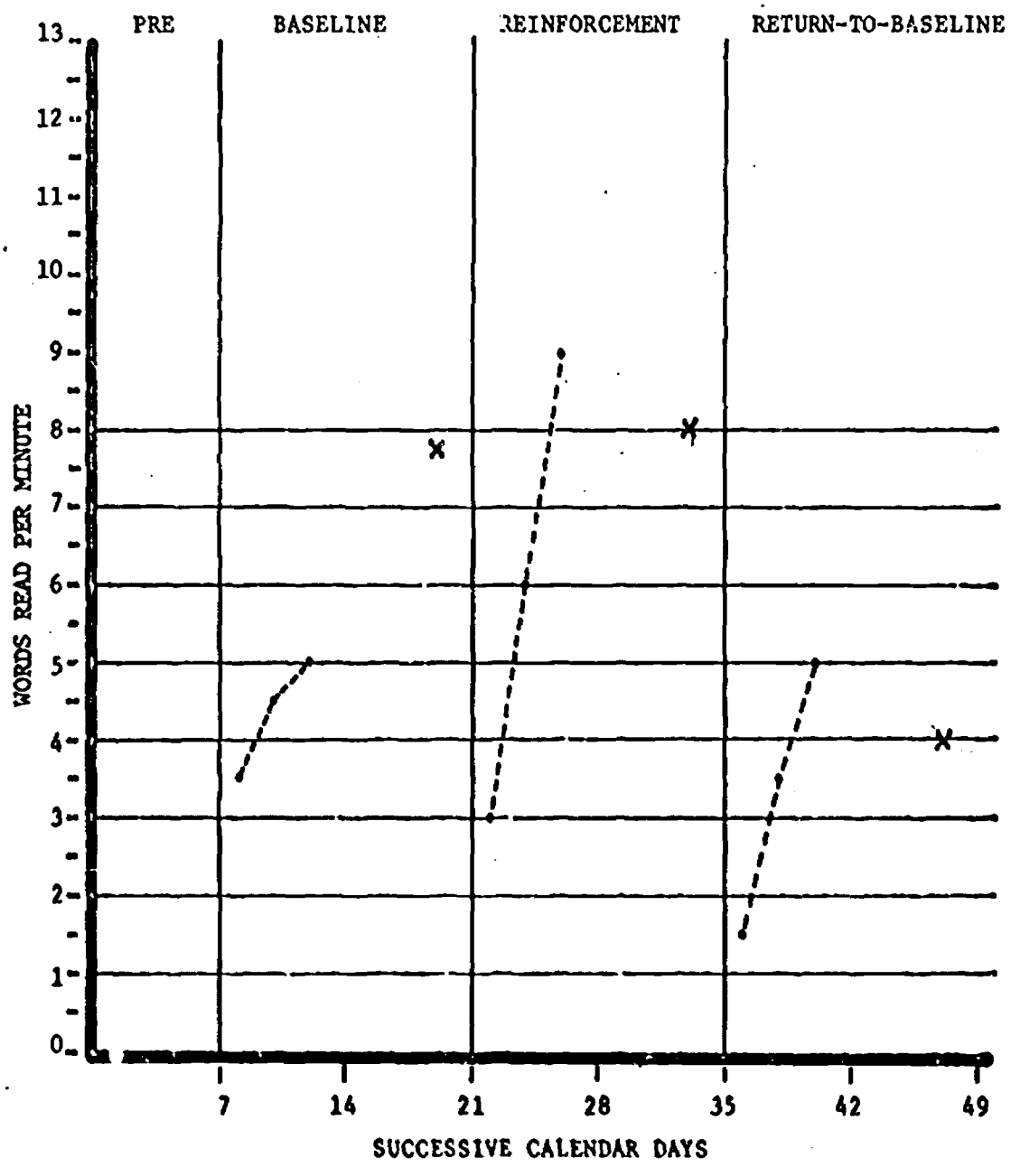
/up/

APPENDIX F



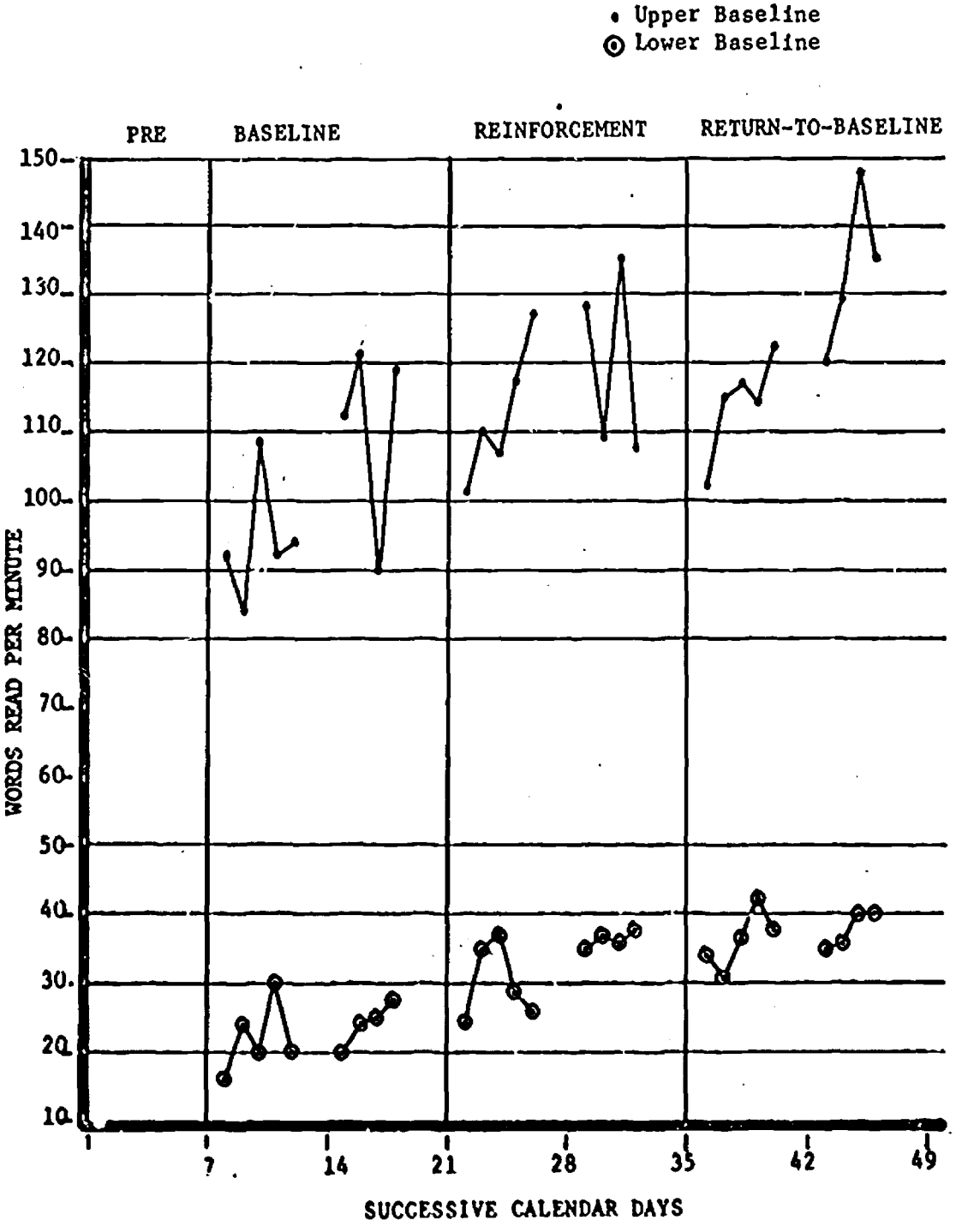
Median scores of the 22 subjects on the Standard Task.

APPENDIX G



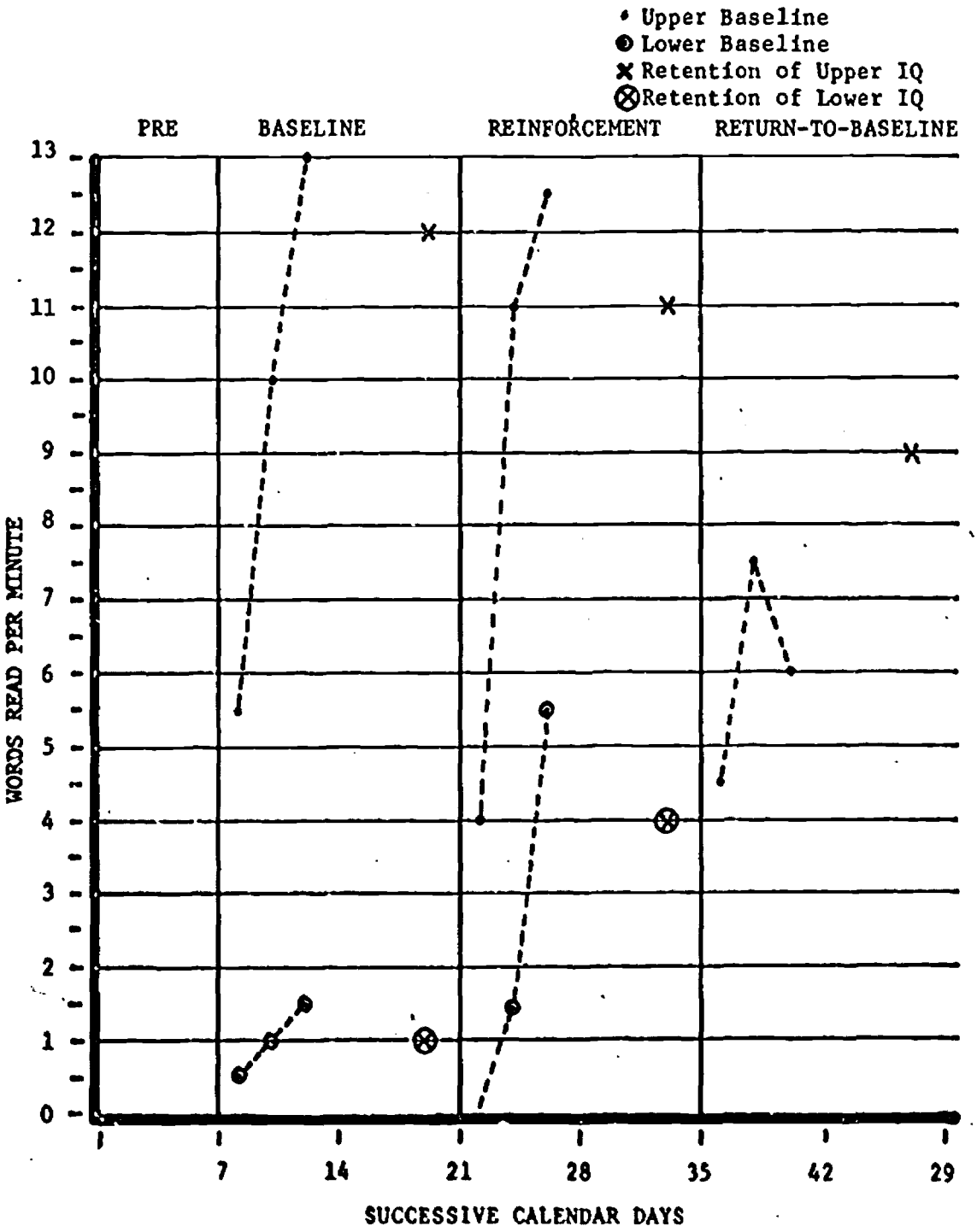
Median scores of the 22 subjects on the Unique Task.

APPENDIX H



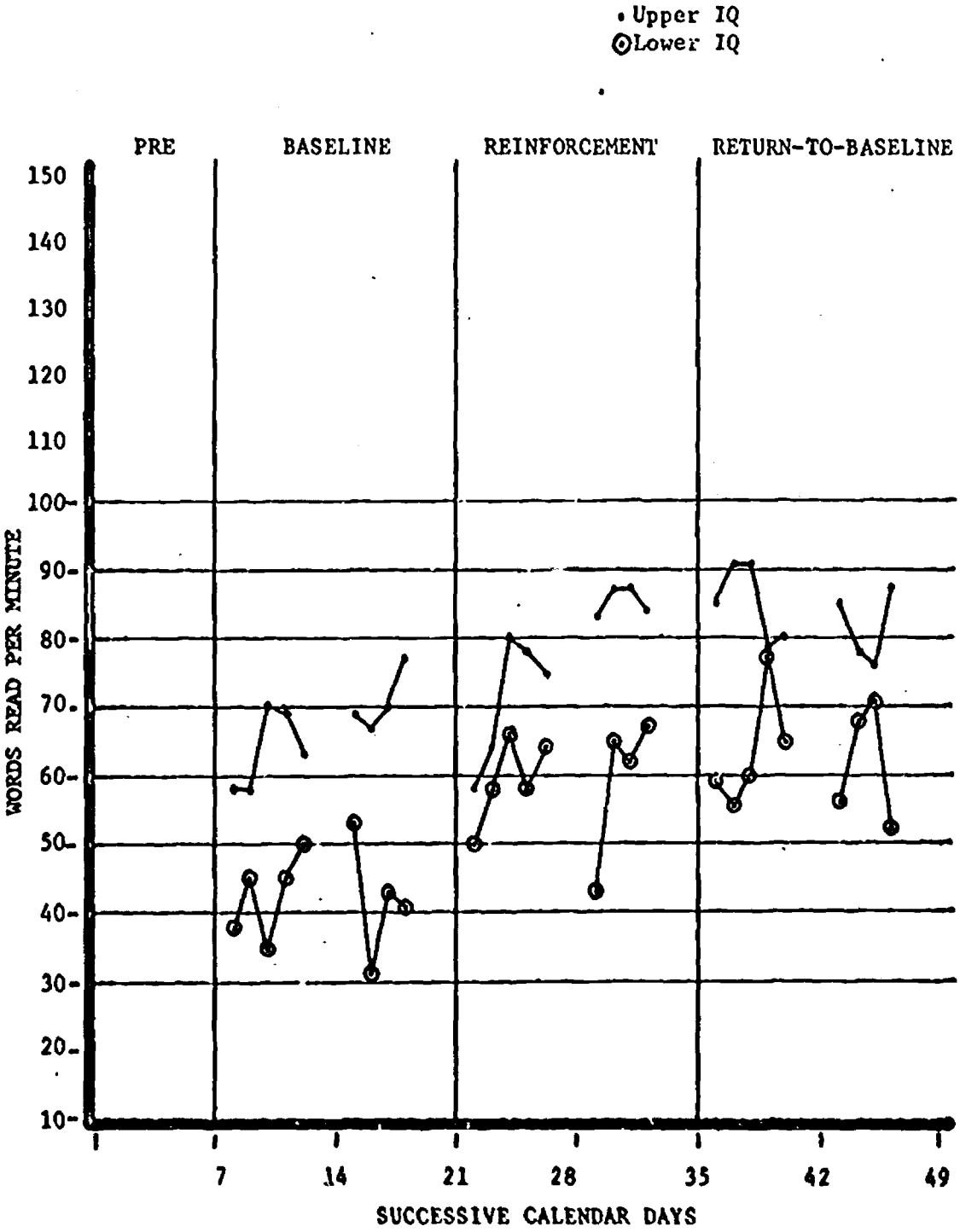
Performance on the Standard Task for the subjects selected on low and high Baseline performance.

APPENDIX I



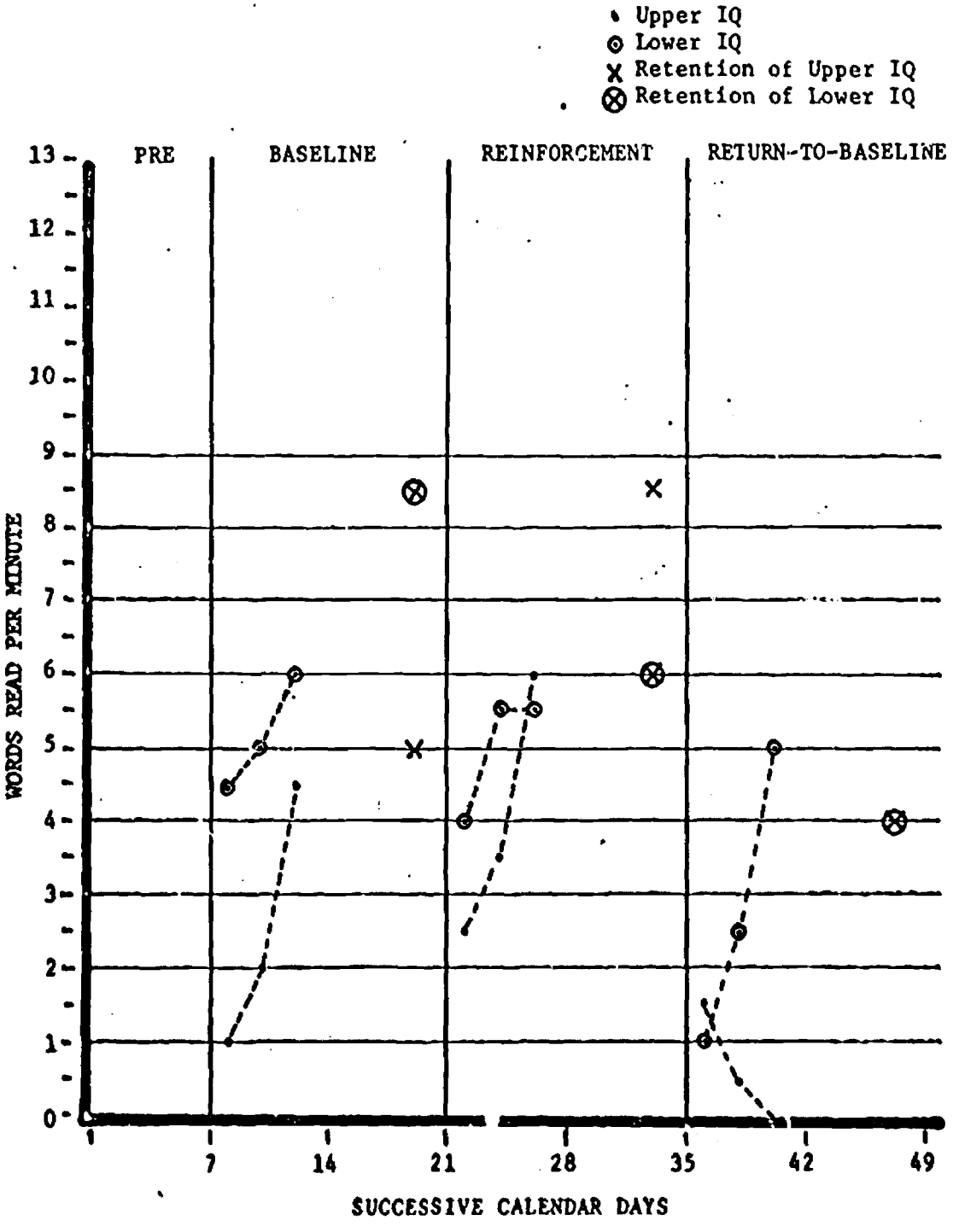
Performance on the Unique Task for subjects selected on low and high Baseline performance.

APPENDIX J



Performance on the Standard Task for subjects selected by lower and upper IQ.

APPENDIX K



Performance on the Unique Task for subjects selected by lower and upper IQ.