

THE UNIVERSITY OF MANITOBA

A COMPARISON OF THE EFFECTS OF NOVEL
VERSUS NON-NOVEL STIMULI IN TEACHING
READING TO CHILDREN WITH READING DEFICITS

by

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ABSTRACT

In controlled laboratory studies, novel stimuli have been shown to attract and maintain attention better than non-novel stimuli. Several investigations with children with reading deficits indicate that novel stimulus materials may also produce better reading performance than more traditional materials, but research on this specific problem is lacking. The purpose of the present study was to compare the relative effects of novel reading materials (in the form of changing colours, shapes, and pictures) and non-novel, paper-and-pencil stimuli (i.e. no colours or pictures, and only oblong and square shapes) on the reading performance of three second grade males. Procedures and reinforcement conditions were held constant for the two conditions.

The study employed an intrasubject design in which each S was exposed to both conditions twice (i.e. four phases), in varying order. Initially, the Ss all made errors on three aspects of reading. They received training related to two of these errors, while the third error functioned as a control. As a measure of the effectiveness of the types of training given, after every session the Ss were required to read three lists of words (generalization lists),

each one related to one of the three errors (i.e. two training lists and one control list). Form A of the Silvalori Informal Reacting Inventory (SIRI-A) and the reading portion of the Wide Range Achievement Test (WRAT) were administered before training and after each phase, as further tests of generalization. The Ss were also tested on the Comprehension, Similarities, Vocabulary, and Block Design subtests on the Wechsler Intelligence Scale for Children (WISC) at all these periods, except the one after the third phase.

It was found that all the Ss improved at significantly greater rates during the novel than the non-novel condition, on both training lists. In addition, for all Ss, the rates of improvement were significantly greater on both the training lists than on the control list, for both the novel and the non-novel conditions. The Ss learned approximately twice as many words on the training lists as on the control list. Generalization occurred not only to the training lists, but also to the other two generalization tests; however, the Ss did not perform significantly better on these tests after the novel than the non-novel condition. The WISC subtest results indicated that reading gains were not simply a function of increasing intelligence.

It was concluded that novel stimuli produce better reading performance than non-novel stimuli,

but that both these conditions are more effective than no training at all. Methodological and practical aspects of this investigation are discussed, and suggestions are made for future research.

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CHAPTER I

INTRODUCTION

The term "reading disability" has been applied in a variety of situations to cover a number of different behaviors. Generally speaking, however, a child with a reading disability is characterized as having average or above intelligence, and yet is performing well below his estimated ability. Also, he does not suffer from any sensory loss, physical disability, or mental retardation. Typically, such a child will exhibit problems such as short attention span (i.e. attending to a task for only a brief time period) and difficulties in reading, such as reversing words (e.g. "saw" and "was") or letters (e.g. "b" and "d"), or responding to only parts of the word (e.g. "set" in "settlement"). Frequently, other disabilities (e.g. difficulties in spelling and writing words, lack of self confidence) are also exhibited when the child finally comes to the attention of authorities. Although these other behaviors are undoubtedly related to reading disabilities, this discussion will focus only on reading problems.

Reading disorders have commonly been attributed to various neurological abnormalities. Such

explanations, however, have very limited empirical support and typically either fail to provide any suggestions for remediation, or else recommend indirect methods that frequently do not succeed (Martin and Gelfant, 1970). In addition, there has tended to be an overconcern among professionals with definition, diagnosis, and labeling, all too often to the exclusion of actual treatment considerations. The most common approaches, their shortcomings, and related research have been described by Martin and Gelfant (1970).

In contrast to such viewpoints, behavioral approaches tend to focus mainly on remediation of the reading disability, which is conceived of as a reading deficit. Definitions, classification, and labeling are, for the most part, ignored, and the actual behaviors of the individual in question are given primary attention, as has been advocated by Lovitt (1969).

From a behavioral standpoint, a complex behavior such as reading is under environmental control and can be altered by manipulating the relevant environmental conditions, regardless of whether or not neurological damage is thought to exist. In their review of the literature on teaching reading by behavioral methods, Goldiamond and Dyrud (1966) stated that it is necessary to develop "an appropriate reading program and an appropriate procedure for maintaining and

guiding behavior through it (p. 115)". They specified further that a behavior modification program should, therefore, involve the following goals:

1. to rearrange existing consequences for certain behaviors (e.g. to provide reinforcement for correctly read words)
2. to bring certain behaviors under the control of specific stimuli (e.g. to teach the child to say "cat" when presented with a written form of the word "cat")
3. to establish new, complex responses not previously in the child's repertoire (e.g. to teach the child to read sentences, paragraphs, stories, etc., when he initially has difficulty reading individual words)

Such an approach accepts and begins with the existing level of performance of the child and then gradually alters it, through a sequence of small steps, to produce the desired behavior. As treatment progresses, reinforcement is gradually made contingent on closer and closer approximations to the goal behavior.

Thus far, behavioral investigations in this area (e.g. Gray, Baker, and Stancyk, 1969; Ryback and Staats, 1970; Staats and Butterfield, 1965; Staats, Minke, Finley, Wolf, and Brooks, 1964) have been

directed primarily toward determining appropriate reinforcing conditions and training procedures. Undeniably, these variables are of utmost importance, but there is also another variable which should be, but has not yet been thoroughly studied by behavior modification researchers--antecedent stimulus conditions. Many stimuli set the occasion for the child's response; these range from the room in which the sessions are held to the reading materials used. As Staats and Staats (1962) have noted, adequate attention to the stimulus materials is prerequisite to the acquisition of reading behavior. Shaping procedures for increasing attention span have been described (e.g. Martin and Powers, 1967). However, it is probable that attention may also be enhanced by making changes in antecedent stimuli.

In laboratory experiments with humans, a number of stimulus properties have been shown to have an effect on the attention paid to stimuli. Using previous animal studies (e.g. Berlyne, 1950a) as a point of departure, Berlyne has conducted a series of experiments with humans. Two major dependent variables were involved: either the choice the subjects (Ss) made between stimuli, or the amount and direction of fixation on one, rather than another stimulus. A number of stimulus variables have actually been investigated, but only one of them will be discussed

here--the novelty, or stimulus change element.

Berlyne (1960) has distinguished three meanings of the word "novelty". A stimulus may be new, or novel, in relation either to an individual's total experience (complete novelty) or to stimuli occurring during a limited time period, such as a few weeks (long-term novelty), or to what has immediately preceded it (short-term novelty). It is the latter type toward which experimental efforts in controlled laboratory settings have been directed. Absolute and relative novelty have also been differentiated. "An absolutely novel stimulus would be one with some quality that had never been perceived before, while a relatively novel stimulus or stimulus pattern would possess familiar elements or qualities in a combination or arrangement that had not been met with in the past (Berlyne, 1960, p. 19)." It has been suggested (e.g. Berlyne, 1950a; Piaget, 1936) that relatively novel stimuli seem to be more effective in attracting and maintaining attention than completely novel stimuli. That is, loosely speaking, adding a "new twist" to things may be a more powerful attention-getter than trying something completely different. However, this notion remains to be substantiated by research. Existing studies on novelty have typically employed what appear to be relatively novel stimuli, but it is difficult in practice to specify precisely what would

constitute a completely novel stimulus in these situations.

The investigations have been conducted with both adults and children. Beginning with the adult studies, in 1951 and 1957(a), Berlyne's apparatus consisted of a vertical board with four square openings in a line and a telegraph response key. It was found that the Ss tended to respond to novel colours (1951) and to novel colours and shapes (1957a). Then in 1958 (a), Berlyne presented the Ss with two figures simultaneously, one remaining the same for a number of trials and the other changing on each trial. The results indicated that the fixation time for the varying stimuli progressively increased over trials, while the recurring stimulus was fixated less and less.

Similar results have been obtained with children. Lewis, Goldberg, and Rausch (1967) found that 3 $\frac{1}{2}$ -year-old Ss spent less and less time looking at a given figure, the more it was repeated, but fixated much longer when a novel stimulus was introduced after a number of trials with a recurring one. It was possible to maintain attentive behavior in the laboratory setting for approximately 30 min. by varying the stimulus input periodically. It has also been found that novel toys are consistently preferred to familiar ones by 12-month-old infants (Ross, Rheingold, and Eckerman, 1972) and by preschoolers (Endsley, 1967).

The preceding experiments, demonstrating that stimulus novelty has an important positive effect on attention, have all been conducted in controlled laboratory settings and have involved relatively simple responses. When a complex behavior such as reading is examined in the natural environment, using children with reading deficits as Ss, the stimulus situation becomes much more complex, and measurements such as fixation time are not only more difficult to make, but also somewhat impractical; actual reading performance is of much greater importance. It would therefore be more useful (although perhaps also more indirect) to determine the effect of novel stimuli on variables such as number of correct responses.

Two case studies, while not specifically investigating the effects of stimulus novelty, have provided impetus for examining this variable more fully. Roberts (1971) conducted a study with a second grade male of normal intelligence with reading and printing deficits. The experiment was concerned with teaching these two behaviors simultaneously. The procedure for teaching reading involved the use of coloured words and a portable apparatus with lights, buttons, and windows (a simplified version of one developed by Staats, Finley, Wolf, and Brooks, 1964), while in the printing phase, paper-and-pencil stimulus materials were employed. It was found that the S

consistently performed much better on the reading than the printing task. Although procedural differences may have accounted for some of this inequality, it was suggested that the apparatus, which was a novel stimulus for the S, in relation to his previous reading experiences, may also have been responsible for the differential performance. Anecdotal information from the study tended to support this; the S's comments and eagerness to use the apparatus stood in marked contrast to his behavior during the printing phase (e.g. looking around the room, doodling). Stuart (1970) has described another novel, yet easily constructed and economical mechanical apparatus which he employed successfully in teaching visual tracking to a fifth grade boy with reading difficulties. Again, however, no data was collected on the effect of the stimuli used. These studies do, nevertheless, tend to suggest that novel materials may be valuable in initiating reading progress in children who have deficits in this behavior.

Novelty in these two case studies was closer to Berlyne's (1960) long-term or complete novelty definitions, discussed previously, than to the short-term kind employed in the controlled laboratory studies, although aspects of the latter type were incorporated in such components as changing colours (e.g. Roberts, 1971).

In everyday situations, long- and short-term novelty may be introduced into reading lessons in many other ways. A number of well-known techniques incorporate the novelty variable through a variety of sensory modalities. For example, Moore (1963) has developed a method to teach reading and printing simultaneously. He designed a talking typewriter which required the child to press electrical typewriter keys in response to a visual or auditory stimulus (e.g. a picture of a cow on the screen or a tape saying "cow"). The correct keys were initially illuminated, but after a period of training this prompt was gradually faded out. Fernald (1943) has introduced a method of teaching reading which employs visual, auditory, kinesthetic, and tactile (VAKT) stimuli. That is, the child sees the word, hears it, traces it, and writes it. Novel stimulus materials such as sandpaper letters have been used with this technique. A third example of a novel approach is Words in Colour (Gattegno, 1962), a program in which 48 phonetic sounds are colour-coded to facilitate reading (e.g. red is used for the short "i" sound in words such as "senate", "mountain", and "pretty"). More complete descriptions of these, and other novel approaches have been provided by Ebert (1970) and Money (1966).

Unfortunately, the originators and major proponents of these methods have not usually deemed it

very important to conduct research on the stimulus novelty variable, or any other aspect of their methods. This latter point introduces a general problem in the field of reading: there is a wide variety of theories and techniques of remediation, but very often the supporters of each one believe that their theory and method are obviously correct and that research to support their claim would be superfluous. This is unquestionably an unscientific approach to the problem of how to teach reading, and one which must be rectified in future work, if scientific advances are to be made.

Using, as a point of departure, the results and limitations of previous studies and techniques, as well as the absence of research in many cases, it is possible to proceed to an investigation of the efficacy of novel stimuli in a systematic behavioral program for children with reading deficits.

The problem of selecting appropriate stimulus materials for the study is an important prior concern. As has been previously noted, there are many different materials available for teaching reading. Some, however, are eliminated because of certain difficulties. For example, they do not involve stimulus novelty, do not teach the child to comprehend what he reads, are not systematic in nature, are too costly, and so forth.

The Programmed Reading Kits 1 & 2 (PRK 1 & 2) developed by Stott (1970) have not yet been employed in research, but are, nevertheless, used quite frequently by teachers and reading specialists to modify reading deficits. These materials would be particularly suitable for a study on stimulus novelty for a number of reasons.

First, they are being widely used without having any empirical basis for their efficacy, thus far. Second, this is a systematic reading program involving an orderly progression from learning simple sound-symbol relationships, through blending sounds, to reading words, sentences, and stories. Considerable practice is provided at each stage. The child may start at the beginning of the program, or at some point in the middle, and progress through to the end, or he may only work with the sections covering his specific deficits. Third, the PRK 1 & 2 may be viewed as a novel set of stimuli for children who have been taught with more traditional materials, since they contain repeatedly changing colours, shapes, and pictures. Short-term novelty is thus involved, and possibly long-term novelty as well, if the child has not been exposed to materials such as these for some time. The PRK 1 & 2 can also fit into the category of relatively novel stimuli, since they bear certain resemblances to more traditional materials. Fourth, many sections of the

PRK 1 & 2 are designed so that, in order to do well, the child must comprehend the meaning of what he reads, rather than just sounding out the words. Fifth, overt responses are required, making accurate recording and reinforcement possible. Finally, because of the systematization of the materials and the precisely specified procedures, it is feasible to reproduce the stimuli in a non-novel, paper-and-pencil form, and alter the procedures only to the extent of eliminating the novel aspects.

CHAPTER II

STATEMENT OF THE PROBLEM

The purpose of the present study was to subject the same Ss repeatedly to both a novel and a standard, or non-novel, set of stimulus materials, with procedures and reinforcement conditions held constant, and to determine the effect of such a manipulation on performance. The hypothesis was that the Ss would respond better under the novel than the standard stimulus conditions, as measured on tests for generalization to other reading stimuli, administered under each condition.

This study was intended to make a step toward clarifying the effects of novelty (in the form of changing colours, shapes, and pictures) in reading, as well as toward correcting the deficiency of research on reading materials, and stimulating this goal in others.

CHAPTER III

METHOD

A. Subjects

The three Ss were second grade males from a Winnipeg elementary school. They were selected by the resource and classroom teachers because they were judged to be deficient in reading relative to their grademates.

Peter was 8 yr. 2 mo. at the beginning of the study. His tested Full Scale IQ on the WISC at this time was in the high average range. Robbie was 7 yr. 2 mo., with a WISC IQ in the lower part of the bright normal range. The third S, Marvin, was initially 7 yr. 6 mo., and had a WISC IQ in the high average range.

The Ss were each tested individually on SIRI-A to determine what specific errors they made. It was found that all the Ss had three general reading difficulties in common:

1. vowel combinations and vowel-consonant combinations, such as "aw", "ou", and "ough" (Error A)
2. long words of three or more syllables (Error B)
3. similar words with and without the silent "e",

such as "mad" and "made" (Error C)

Throughout the study, none of the Ss was receiving any extra tutoring from a resource teacher, reading clinician, or parent.

B. Materials

The materials primarily consisted of the PRK 2. More specifically, two sections of it were employed as the novel stimuli (PRK): the Colour Sounds and Snakes (dealing with Error A) and the Long Word Jigsaws (dealing with Error B). These sections are described in Appendix A. The standard stimuli (SS) were constructed by hand printing on pieces of white foolscap, with a black felt marking pen, the words and sentences from these two sections, to form flash cards.

Three lists of 50 words each (see Appendix B) were compiled on the basis of the three errors (Errors A, B, and C) made on the SIRI-A. These lists were composed of words not contained in the assessment or training materials. Each list of words was printed on a separate sheet of foolscap. On the list corresponding to Error A (List A), the number of words per sound (e.g. the long "e" sound, as in "green", "leaf", and "brief") taught in the training sessions was approximately proportionate to the amount of practice provided on that sound in the materials. The list corresponding to Error B (List B) was composed of 36 three-syllable words and 14 four-syllable words, in proportion to the

number of practice words of each syllable length in the training materials. Half of the list corresponding to Error C (List C) was composed of words with a short vowel and no silent "e" (e.g. "sack") and the other half was composed of similar words with the same vowel lengthened by the silent "e" (e.g. "sake").

Copies of the WISC, WRAT and the SIRI-A were required for assessment and evaluation. These tests are described in Appendix C. An assortment of stars and stickers and bags of candy were employed as reinforcers. Each child was provided with a large sheet of cardboard, marked off in 2 in. squares, on which to paste his stickers, as he earned them.

C. Procedure

Assessment. Before intervention was begun, (Test Period A) each S was individually tested on:

1. the WISC
2. the reading portion of the WRAT
3. the SIRI-A

Intervention.

Design. The study involved a multiple baseline design in which each S was trained on materials dealing with Error A and Error B, while Error C served as a control which was observed in the absence of training related to it. Each S was exposed to each of the two conditions--PRK and SS--twice, resulting in four

phases. The order of exposure varied for each S (see Table 1), to control for order effects. No reversals to conditions of non-reinforcement were conducted, since this would have been undesirable to the school and parents involved, and may not even be possible with a behavior such as reading (Wolf, Giles, and Hall, 1968).

Training. After the reading and reinforcement procedures (to be described below) had been explained to the SS, training was begun. The PRK and SS materials were presented to the SS according to the instructions provided in the PRK 1 & 2 Manual (see Appendix B). During the SS condition, however, a few minor substitutions were made so as to eliminate novel portions of the procedure. After each response the experimenter (E) said either, "Yes, that's right." (or a similar statement) if the S was correct, or "No, it should be _____. Now you try it.", if the S responded incorrectly.

There were six 30 min. training sessions for each S during each phase. These sessions were conducted in the afternoon, three times a week. Approximately one-half to two-thirds of the training time was devoted to materials dealing with Error A, and the remainder of the time was spent on those related to Error B.

Evaluation. Two kinds of dependent variables were employed. First, within each phase a measure was

Table 1
Order of Exposure to the Conditions

<u>S</u>	Phase 1	Phase 2	Phase 3	Phase 4
Peter	PRK	SS	PRK	SS
Robbie	PRK	SS	SS	PRK
Marvin	SS	PRK	SS	PRK

made at the end of each session. This consisted of Lists A, B, and C, administered to each child. The Ss were required to read the words aloud, without feedback as to the correctness of their responses. The number correct was recorded for each session.

The reliability of observations during the Ss' reading of Lists A, B, and C was assessed in one session in each phase. Each S's responses were tape recorded and a second observer, who had been provided with a list of all the words in their order of presentation, independently scored them as correct or incorrect.

At the end of each of the four phases, (Test Periods B, C, D, and E) the reading portion of the WRAT and the 160 graded words from the SIRI-A were re-administered to each S. The Comprehension, Similarities, Vocabulary, and Block Design subtests of the WISC were given after all but the third phase, to determine whether increments in reading scores paralleled increases in IQ. The Ss were not provided with any feedback about their performance on any of these measures.

Reinforcement. Reinforcement was of two kinds. During the actual training sessions, after every 25 correct responses each S was allowed to choose a sticker and paste it on his card. When he had earned five stickers, he received a note to his teacher and another to his parents (See example, Appendix D)

reporting on his progress. The notes, which were always positively worded so as to emphasize the child's successes, were read to him by the E when he had earned them. He was verbally praised each time he earned a sticker or a note.

Reinforcement was also given to the Ss for reading the word lists and doing the tests at the end of each phase. However, this reinforcement was not contingent on correct responses, since no feedback was given; the purpose of the reinforcement was to motivate the Ss to read the materials and perform on the WISC subtests. This reinforcement was in the form of candies. Each S was allowed to choose a candy after he had completed each list. He was also permitted to select a candy after finishing the reading portion of the WRAT, after reading every 80 words on the SIRI-A, and after responding to the WISC subtests.

CHAPTER IV

RESULTS

The number of words correct on Lists A, B, and C, the SIRI-A, and the reading portion of the WRAT were each converted to percent correct. This measure was used as the major dependent variable because it approximates more closely the situation that typically exists in the classroom. In this form, the data will give a better indication of how the stimulus novelty variable would affect reading performance in the natural environment. The raw scores obtained on the WISC subtests were converted to scaled scores, which indicate where the S's score falls in relation to other children his own age, a score of 10 being the average.

The graphs in Figures 1, 2, and 3 show the performance of Peter, Robbie, and Marvin, respectively, on Lists A, B, and C. A regression analysis was performed on the data for Lists A and B, for each S. A comparison of the rates of increase in number of words correct in the PRK condition versus the SS condition, for each S, indicates that the rates are significantly greater under the PRK condition than the SS condition on List A (see Table 2) and List B (see Table 3). This would also hold true for percent correct. Under both conditions, improvement within a phase was slightly

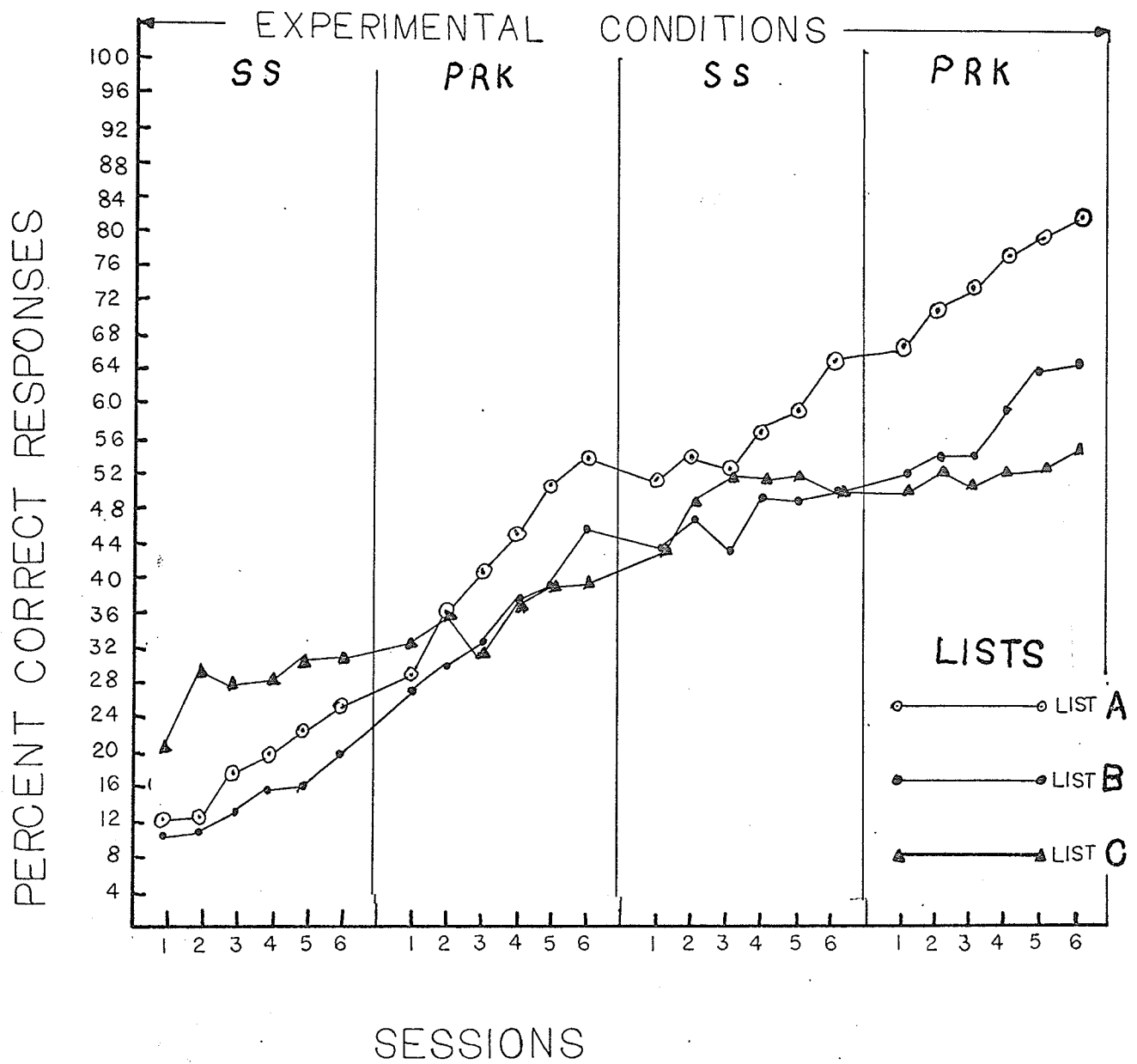


Figure 1. Percent Correct Responses on Lists A, B, and C in the PRK and SS Conditions: Peter

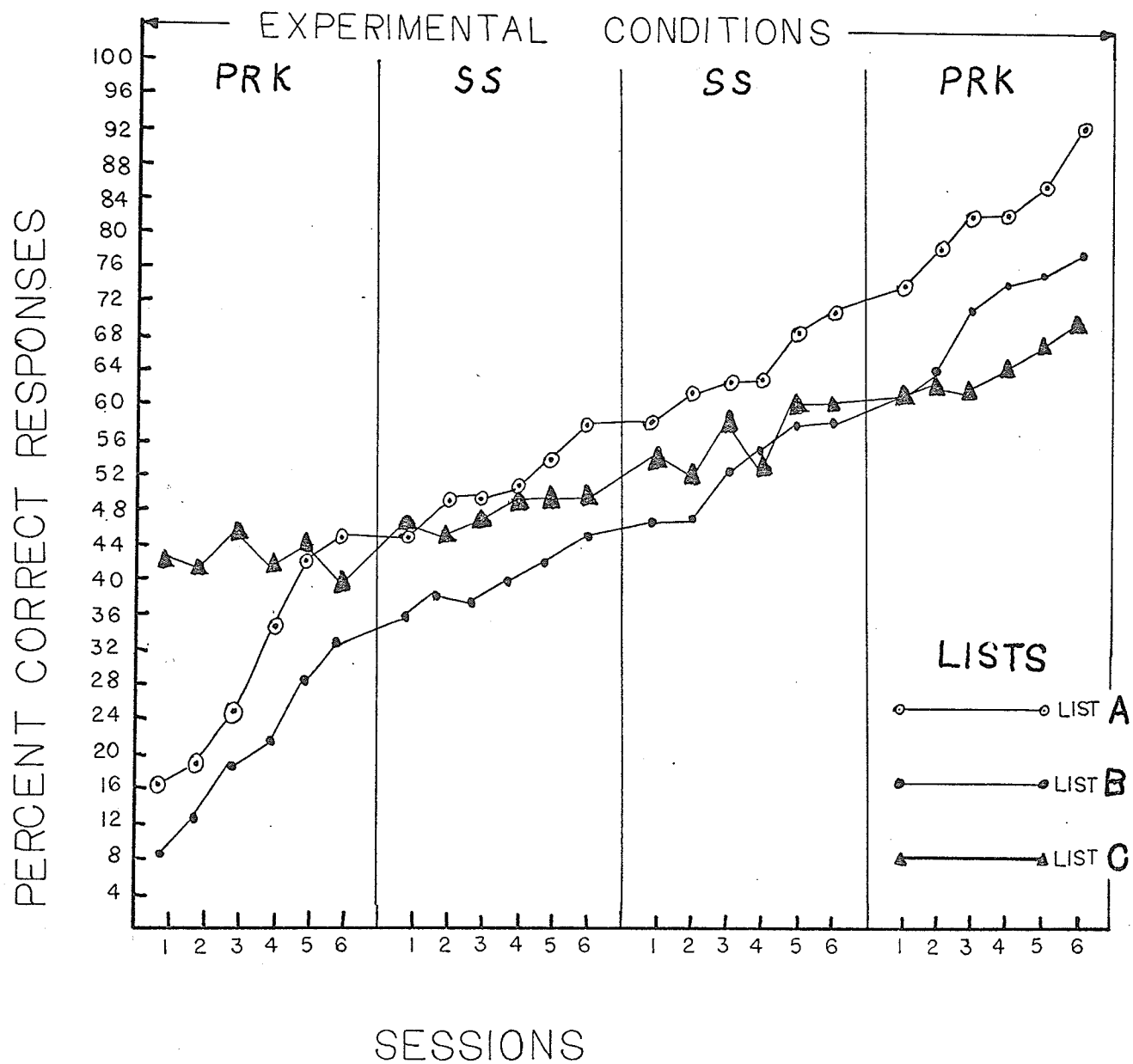


Figure 2. Percent Correct Responses on Lists A, B, and C in the PRK and SS Conditions: Robbie

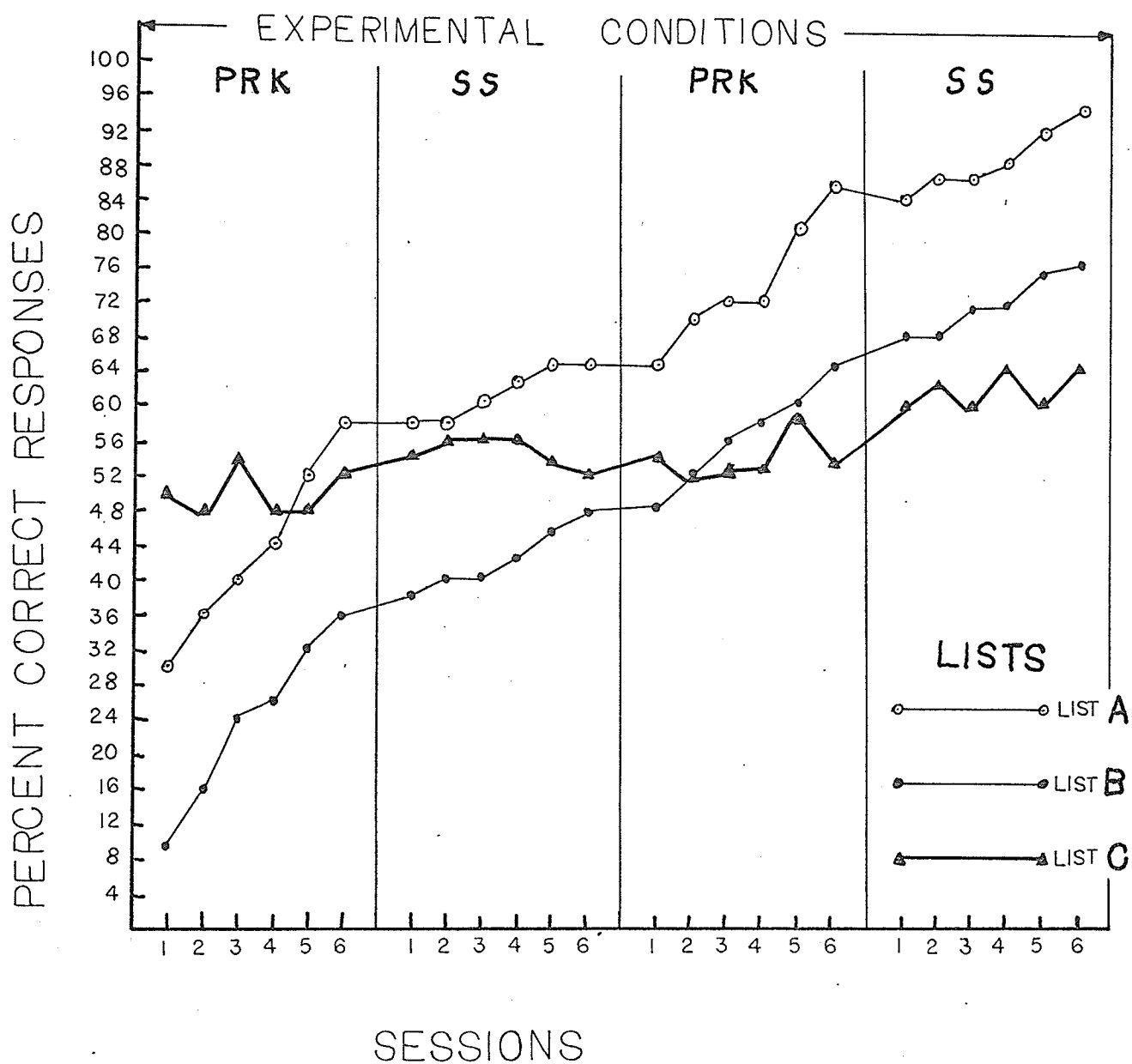


Figure 3. Percent Correct Responses on Lists A, B, and C in the PRK and SS Conditions: Marvin

Table 2

A Comparison of the Rates of Increase
in Number Correct on List A, in the
SS versus the PRK Condition

<u>S</u>	<u>Slope Estimates</u>		<u>t</u>
	PRK	SS	
Peter	2.37	0.88	2.40*
Robbie	2.36	1.13	1.92*
Marvin	2.14	1.14	1.89*

*df = 18, $p < .05$

Table 3

A Comparison of the Rates of Increase in
Number Correct on List B, in the
SS versus the PRK Condition

<u>S</u>	Slope	Estimates	<u>t</u>
	PRK	SS	
Peter	2.73	0.84	3.19**
Robbie	1.84	0.89	2.02**
Marvin	1.64	0.61	1.91*

*df = 18, $p < .05$

**df = 18, $p < .01$

greater on List A than on List B, in all cases but one (see Figures 1, 2, and 3).

It can also be seen from these graphs that performance on List C, the control list, increased slightly for all Ss from the beginning to the end of the study. A regression analysis and comparison of the rates of increase in number of words correct on the training lists, A and B, versus the control list, C, were performed for each condition. It was found that gains on Lists A and B occurred at a significantly greater rate than on List C, for all three Ss, during both the PRK condition (see Table 4) and the SS condition (see Table 5). While gains on Lists A and B were either maintained or increased over sessions, performance on List C was more variable. Once a word was read correctly on Lists A and B, it was more likely to be read correctly in the following sessions, than on List C, where words read correctly one or more times were often later read incorrectly.

A word cannot really be considered learned, however, until it is reliably read correctly. Because from session to session the Ss did not always have the same words correct, an estimate of the percentage of words learned, over all sessions, was needed. First, the words each S did not read correctly three times consecutively at the beginning of Phase 1, were identified. These same words were then examined at the end

Table 4

A Comparison of the Rates of Increase in
Number Correct on List A vs. List C,
in the PRK Condition

<u>S</u>	Slope Estimates			A vs. C	B vs. C
	List A	List B	List C	<u>t</u>	<u>t</u>
Peter	2.50	2.16	0.16	3.41*	3.39*
Robbie	2.36	1.97	0.19	17.30**	4.46**
Marvin	2.00	1.64	0.34	4.34**	5.38**

*df = 18, $p < .005$

**df = 18, $p < .0005$

Table 5

A Comparison of the Rates of Increase in
 Number Correct on List A vs. List C
 and List B vs. List C, in the
 SS Condition

<u>S</u>	Slope Estimates			A vs. C	B vs. C
	List A	List B	List C	<u>t</u>	<u>t</u>
Peter	0.86	0.84	0.02	6.1*	6.5*
Robbie	1.13	0.66	0.40	6.73*	6.95*
Marvin	1.14	0.61	0.24	6.29*	8.02*

*df = 18, $p < .0005$

of Phase 4. Under this criterion, Peter learned 58% of the words that he missed initially on List A, 62% of the words on List B, and 26% of the words on List C. Robbie learned 68% of the words on List A, 60% of List B, and 32% of List C. Marvin learned 62% of List A, 50% of List B, and 28% of List C. It also happened, on all lists, that some incorrect pronunciations of words were learned; that is, because no feedback was given, the S sometimes made the same error in one session after another. This occurred more frequently on List C, because they were not receiving training related to Error C.

The Ss' scores on the SIRI-A before training was begun, and after each phase, are shown in the graph in Figure 4. The increases were slightly greater after the PRK condition than after the SS condition, in all cases but one. However, when the Mann-Whitney Rank Sums Test was performed on the increases after the two conditions, it was found that there is no significant difference between these increases.

The WRAT reading scores are plotted in Figure 5. The Mann-Whitney Rank Sums Test showed the same results here as with the SIRI-A.

Each S's scaled scores on the four WISC subtests, at each test period, appear in Table 6. It can be seen that there is no systematic increase in scores over time, but rather, they fluctuate.

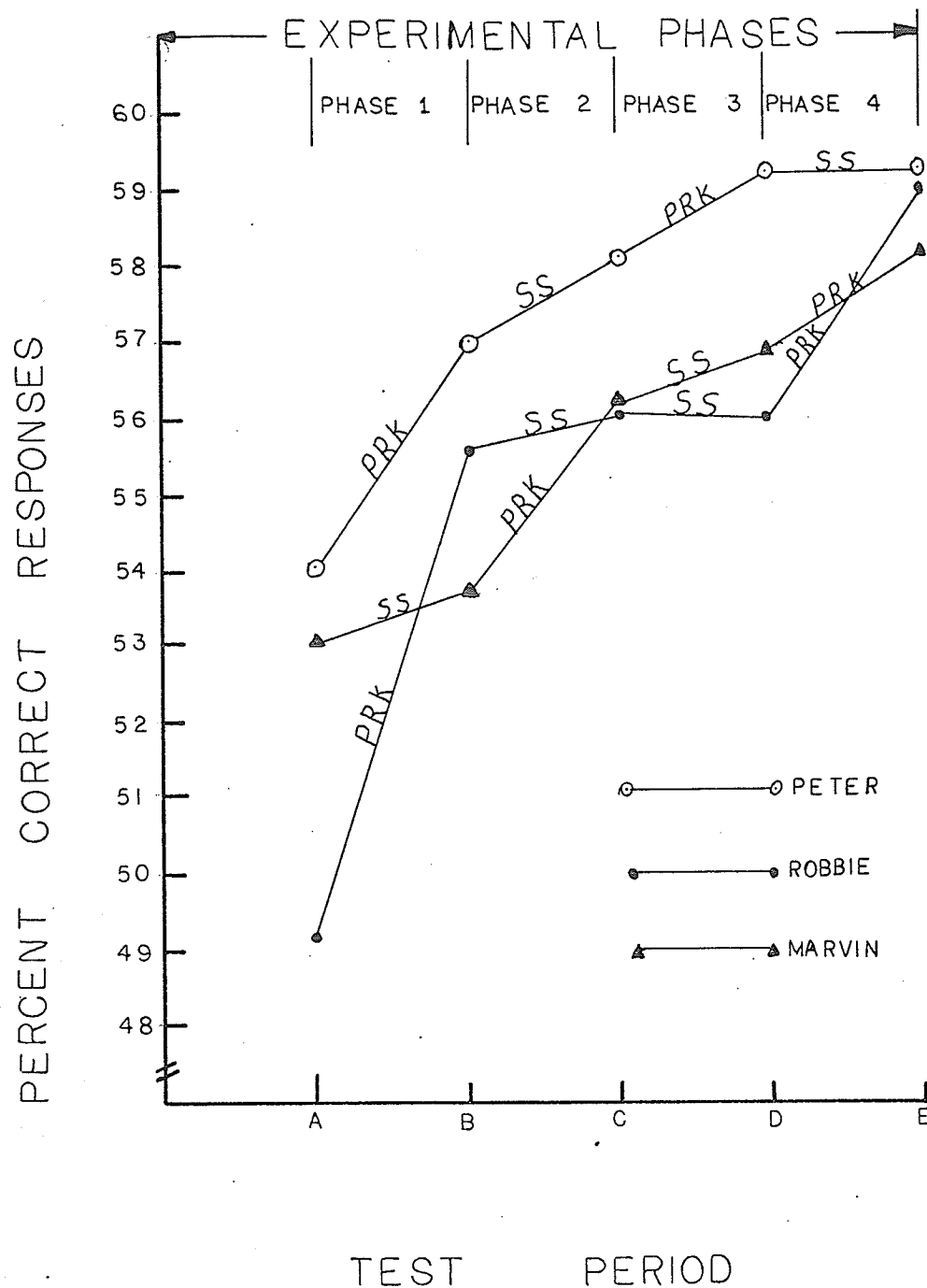


Figure 4. Percent Correct Responses on the Reading Portion of the WRAT for Each S at Each Test Period

Note: Numbering of Percent Correct Responses Begins with 48.

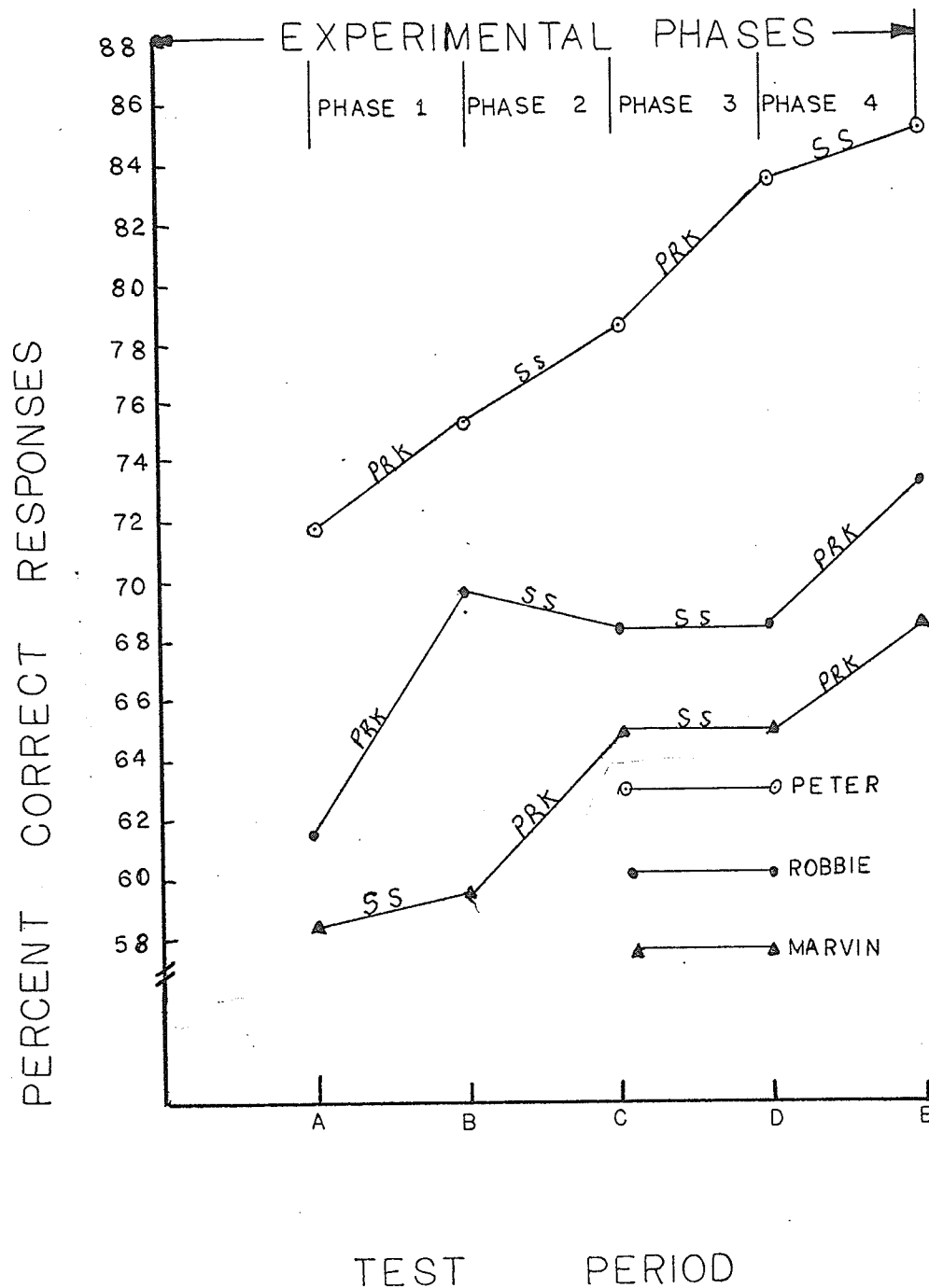


Figure 5. Percent Correct Responses on the SIRI-A for Each S at Each Test Period

Note: Numbering of Percent Correct Responses Begins with 58.

Table 6

Scaled Scores at each Test Period, on the
Comprehension, Similarities, Vocabulary,
and Block Design Subtests of the WISC

<u>S</u>	Subtest	Test Period*			
		A	B	C	E
Peter	Condition	PRK	SS	PRK	SS
	Comprehension	10	9	6	10
	Similarities	6	7	7	7
	Vocabulary	12	11	9	10
	Block Design	9	9	9	10
Robbie	Condition	PRK	SS	SS	PRK
	Comprehension	13	10	14	14
	Similarities	11	15	13	15
	Vocabulary	13	12	11	12
	Block Design	12	15	15	16
Marvin	Condition	SS	PRK	SS	PRK
	Comprehension	8	9	14	11
	Similarities	6	6	8	8
	Vocabulary	10	9	8	8
	Block Design	15	12	9	14

*The subtests were not administered in Test Period D.

The reliability of observations during the reading of Lists A, B, and C was computed by dividing the number of agreements between the E and the second observer, by the sum of the number of agreements plus disagreements. This number was then multiplied by 100% to convert it to a percentage. The reliability was 99.1% for Phase 1, 99.8% for Phase 2, 99.5% for Phase 3, and 99.8% for Phase 4.

CHAPTER V

DISCUSSION

The results show that, for all Ss, the PRK condition did, in fact, produce significantly greater rates of improvement in correct reading responses on Lists A and B than did the SS condition. This was supported by the Ss' comments during the study; on a number of occasions, an S would ask when he was going to use the PRK materials again, or comment that he preferred them to the SS materials. Order effects were not confounded with condition effects, since the results were replicated across Ss, although the order of presentation varied for each S. Thus, the results suggest that novel materials such as those studied (i.e. changing colours, shapes, and pictures) should be used in teaching reading. These materials obviously constitute a stimulus package, and no statements can be made as to which of the three variables, or combinations of variables, were responsible for the better performance under the PRK condition. With a complex behavior such as reading, however, it is unlikely that a single variable, such as changing shapes, would have produced a differential effect. It was mainly for this reason that a stimulus package composed of three elements was selected as the major independent variable.

On the basis of this investigation, no definite statement can be made as to why the Ss performed better under the PRK than the SS condition. But it may be hypothesized that the PRK materials maintained attention better because of their novelty, and perhaps because they suggested a game. As a result of the attention paid to the materials, the Ss may have retained better what they learned. This hypothesis is drawn from the laboratory studies (e.g. Berlyne, 1957a, 1958a; Lewis, Goldberg, and Rausch, 1967) discussed previously, which found that attentive behavior was maintained longer by stimulus novelty. However, the hypothesis is actually an extension of the laboratory findings, because it is not "looking time" that is measured, but rather performance on what are actually tests for generalization of learning. As was pointed out previously, when dealing with a behavior such as reading, it is of little practical value to focus on such variables as "looking time"; measures such as percent correct, while being more indirect, approximate the real-life situation more closely.

The fact that the measures employed were tests of generalization, rather than simply measures of recognition of words used in training, is important in and of itself. The goal of any remedial reading program should not be just to help the child read certain words, but rather to improve his reading in

general. Thus, the results show that generalization to other materials was actually occurring, and that this generalization was greater under novel than non-novel conditions.

Although the Ss improved on both Lists A and B, the increases on A were found to be small, but consistently greater than the increases on B, in all cases but one. There are two possible explanations for this. First, a little more time in each session was usually devoted to work related to Error A, and second, this training dealt explicitly with the phonic conventions the Ss encountered on List A. Training related to Error B, on the other hand, dealt more with how to attack long words, although the phonic conventions learned in the work pertaining to Error A probably helped the Ss handle the long words, as well. Marvin did not make as many gains on List B as the other Ss, most likely because he did not generalize as well from the training to the list. That is, he did not take the time to look carefully at all the long words on the list and break them down into smaller parts, as he was required to do in the training sessions.

It was also found that all the Ss improved at a significantly greater rate on both Lists A and B, than on the control list, C, under both the PRK and SS conditions. This indicates that the improvements made on List A and B were due to the training received

and not simply to other factors, such as the passage of time or the attention the Ss received. The fact that the WISC subtest scaled scores fluctuated from one testing to the next, rather than systematically increasing, indicates that the gains in reading scores were not merely a function of increasing intelligence, either.

When the percentage of words learned was calculated, it was found that the Ss learned approximately twice as much on each of Lists A and B, as on List C. Although this measure of words learned is admittedly only an estimate of actual learning, it does give a better approximation of how well the goal of teaching reading is met, than would simply measuring the gain in percent correct from the beginning to the end of the study.

It was noted earlier that performance on List C was more variable than on Lists A and B, in that a word on List C, unlike those on the training lists, was often read incorrectly after being read correctly one or more times. This was probably because the Ss were making many guesses on the control list, rather than learning, as on the other two lists.

The results indicate that both the PRK and the SS conditions were more effective in teaching reading than no training at all. However, there was some improvement on List C as well, for at least two

reasons. First, the Ss were learning new words in their classroom reading lessons. Second, the three errors were not entirely independent of each other. Although no word was on more than one list, learning to read some of the phonic conventions and words helped in reading others. For example, learning the phonic convention "ate", as part of the training related to Error A, may have helped the Ss to read the word "deflate" on the control list.

The high inter-scorer reliability coefficients show that the E's recording of the Ss' reading responses on Lists A, B, and C was highly reliable. Most of the few discrepancies that did occur were due to the fact that, on certain words, the Ss' voices were not clearly audible on the tape, although they were in the actual session.

It was also found that improvement on the SIRI-A and the reading portion of the WRAT was not significantly greater after the PRK condition than after the SS condition, although there was improved performance after both conditions. The SIRI-A and the WRAT are also generalization tests, in that the Ss were not trained on the specific words on them, but rather on similar ones. However, these tests were less similar to the training materials than were the lists, and so perhaps more training would be needed to register significantly different gains. The WRAT, in particular,

contains many irregular words, so that the training received would not be especially helpful in reading these words.

Certain methodological and practical aspects of this investigation must now be examined. First, since this study was designed to involve a behavior modification reading program, it should satisfy the three major criteria Goldiamond and Dyrud (1966) have specified that a behavior modification program should meet. The first was that existing consequences for certain behaviors should be arranged. This was done by introducing reinforcement for correctly read words. The second criterion was that certain behaviors should be brought under the control of specific stimuli. This was met by teaching the Ss to say certain sounds when presented with certain letter combinations, and to break up long words into syllables and first read each syllable separately, before combining them. The third criterion was that new, complex responses should be established. This was met to the extent that the Ss learned to read vowel combinations, vowel-consonant combinations, and long words.

The reading program in this study should not only have met behavior modification criteria, but should also have been as similar as possible to the types of programs feasible in a resource situation. The study was comparable to a resource situation, in that the

sessions were not held every day, or on weekends and holidays. The resource teacher does not usually have a great deal of time to spend with any one child. The two situations were further comparable, in that the E was a female and the resource teacher is usually also a female. Third, reinforcement in the form of praise and stickers, which were used in the investigation, are common in the resource situation.

The program was, however, unrealistic in that each S was seen individually; most often the resource teacher works with at least two children at a time, because it would be too costly, in terms of time, effort, and money, to see each child in a one-to-one situation. A number of factors change from an individual to a group setting, but perhaps the most important are changes in social interaction variables (i.e. the effects the children have on each other's behavior), less teacher attention to each child, and less monitoring of his work. A one-to-one situation was, however, necessary in this study, because working with more than one S at once would have introduced too many uncontrolled variables.

Another difference between the experimental and the resource situation was that no feedback on test performance (i.e. on Lists A, B, and C, the SIRI-A, and the reading portion of the WRAT) was given in the study, whereas the teacher usually shows the child his errors and tells him the correct responses. It was noted pre-

viously that the Ss learned some wrong responses to words on the lists. For the purposes of the investigation, it was necessary not to correct these. However, in the situation where feedback is given, incorrect responses are much less likely to be learned.

Finally, to qualify as an investigation in the natural environment, this study would have to have been conducted in a real classroom or resource room, possibly by the teacher herself. Because this was not feasible in this situation, the sessions were carried out by the E in a vacant kindergarten room. This was, nevertheless, a better approximation to reality than a laboratory setting.

Several other difficulties and limitations, as well as suggestions for future research, must be mentioned. First, a two- or six-month follow-up would have been desirable, to determine the durability of the behavior changes. This would involve re-administering Lists A, B, and C, as well as the SIRI-A and the reading portion of the WRAT. It is probable that performance would drop off to some extent during the intervening time period, indicating the need for occasional booster sessions to re-establish or exceed the levels achieved at the end of the study. Unfortunately, no definite statement can be made, since a follow-up was not feasible in this case. This feature should, however, be incorporated into future research, where possible.

A second limitation of this study is that only three Ss were employed. Although the results were replicated across these Ss, larger numbers would increase confidence in these findings. The replicability of these results should also be tested with female Ss, and with male Es, so that all four combinations of Ss and Es are studied. It may be that the sex of the S and/or the E is an important variable, and that it may interact with the novelty variable.

Furthermore, an E other than the researcher conducting the study should be employed, to introduce control for E bias. These additions and extensions are all desirable and important, but they require considerable time and money, which were not available for this initial investigation.

Another limitation is that only oral reading of single words was measured. Inferences cannot safely be made from this to silent reading, reading in context, and comprehension; these would have to be measured separately. It is important that the effects of novelty on these variables also be determined, since oral reading of single words, by itself, is required less and less as the child ages. Comprehension is an especially crucial variable, since the child is not really reading if he is simply calling out words without knowing their meaning. The PRK 2 does deal with reading in context and comprehension to a greater extent toward the end

(e.g. The Days-of-the Week Books). These sections can be used for oral or silent reading. Thus, the latter part of the PRK 2 may be employed, in a somewhat similar manner, with more advanced children, to study the effect of the stimulus novelty variable on oral or silent reading in context, and comprehension.

There is another variable that also deserves investigation. It was noted earlier that the PRK materials may have suggested a game to the Ss. Stimulus novelty may be introduced by intentionally teaching reading in the context of playing a game. Here, changes are occurring from one player's turn to the next, depending on what has just happened. The PRK 1 & 2 may be used intentionally as a game between teacher and child. It would be possible, then, to use these materials under two conditions: the first where the procedure involves a game played between teacher and child, and the second where the procedure is altered from the first, only to the extent of eliminating the game variable; that is, it would be like the PRK condition in this study. One difficulty with this, however, is that the second condition, even when compared with the first, may still suggest a game to the Ss. This problem may be solved if it is possible to find relatively non-novel materials, involving a satisfactory reading program, and these materials can be altered so that they can also be used as a game. This remains for future researchers to

determine. Other forms of stimulus novelty (e.g. different textured materials introducing novelty through the sense of touch) should also be investigated.

Thus, it appears that other dimensions of stimulus novelty and a number of other important dependent variables need to be studied. Hopefully, these will be the subject of future research and of extensions of the present investigation.

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APPENDIX A

The training materials and procedures for the PRK and SS conditions are described below.

Vowel Combinations and Vowel-Consonant Combinations

A. Colour Sounds

PRK.

Materials. The PRK2 contains nine cards of different colours. The words on each card have vowels and vowel-consonant combinations pronounced the same as those in the name of that colour (e.g. on the brown card, there are words such as "house", "cow", "bough", and "tower"). The different spellings are separated into different subdivisions. Each subdivision has a phonic convention (e.g. "ow") printed at the top, as well as an example word (e.g. "cow") and a picture of it. On a few cards, words that do not share the sound of the colour name are included, in separate subsections, because there is no colour corresponding to the sound.

Procedure. One card at a time was used. First, the E said the name of the colour and the S repeated it. It was explained to the S that the words on the card have the same sound as the name of the colour. Then the E pointed to and read the phonic convention in the first subdivision, and

said the name of the example word and its picture. She emphasized the underlined phonic convention in the example word. The S was requested to repeat this word. Next, the E pointed to and read each practice word in turn, with the S reading them after her. The S was then required to read each word and write it out. For every correct response (reading and writing a word without errors), he earned one point toward a sticker.

SS

Materials. The practice words in each subdivision of a Colour Sounds card were printed on a separate piece of foolscap, with the phonic convention and example word (with the convention underlined) at the top. There were no colour names or pictures.

Procedure. All the subdivisions corresponding to a Colour Sounds card were dealt with consecutively. The procedure first involved the E's pointing to and reading the phonic convention, saying the example word, with emphasis on the underlined convention, and having the S repeat the word. Then the S was required to read out each practice word, following the same point system as in the PRK condition.

B. Snakes

PRK.

Materials. The PRK2 contain two sets of Snakes and four sets of Snakes Exercises, corresponding

in colour and vowel/vowel-consonant sound to each of the Colour Sounds cards, except the purple one. Each Snake consists of a head, with the beginning letter of the first word to be made, and 16 segments. Word endings, each containing the phonic convention, are printed on the left side of these segments, and beginnings of other words are on the right. Each Snake is accompanied by a Check-and-Score Card of the same colour, listing the number of points allowed for each possible word. Also, there are two sets of exercises for each Snake, on cards of the same colour. They consist of sentences with blanks to be filled in by one of the three words given in brackets after each sentence.

Procedure. After a Colour Sounds card had been completed, the corresponding first Snake was used. The head was placed in a central position, and the S was given eight segments. He was required to choose a segment which, when joined to the beginning letter, would make a word. He then read that word. If the E found it on the Check-and-Score Card, the S was given the appropriate number of points. If the S made a combination that was not a word, he had to take the segment back and try again. If he correctly spelled and read a word, but did not appear certain whether it really was a word, he was questioned about the meaning of it. If he had the right idea, he was given the

appropriate number of points.¹ When as many of the first eight segments as possible had been placed, the S worked with the other eight segments. The second Snake for each colour and the Snakes Exercises were not begun until all the Colour Sounds cards and first Snakes had been completed. In the Snakes Exercises, the S was asked to choose the correct word, and then read the entire sentence.

SS.

Materials. The SS materials corresponding to each Snake consisted of a strip of foolscap with the word endings listed on it, and small squares with a beginning printed on each one. The Snakes Exercises were printed on foolscap, in the same form as in the PRK2.

Procedure. First, the E placed the word endings and a pile of eight beginnings before the S. He was requested to take one beginning at a time and place it before each of the endings. He was to decide which combinations made words, and to read them. As in the PRK condition, in cases of uncertainty he was questioned as to the meaning of the word. All the possible words, along with their respective number of points, were listed on a sheet of foolscap, which the

¹This procedure was introduced as an attempt to control the guessing which sometimes occurred because the Ss wanted to earn as many points as possible.

E used as a score card. The S was allotted the appropriate number of points for correct responses. When he had finished with the first eight beginnings, he was given the other eight. As in the PRK condition, after the equivalents of the Colour Sounds cards and the first Snakes had been completed, the equivalents of the second Snake for each colour and of the Snakes Exercises, were begun. In the latter materials, the S was asked to select the correct word and then read the entire sentence.

Long Words

A. Long Word Jigsaws

PRK

Materials. In the PRK2, there are 48 long words, 35 with three syllables and 13 with four syllables. The words are divided into six sections, each of a different colour. Each word is cut up like a jigsaw, according to the syllable divisions. As a guide to assembly, the same marking runs along the bottom of all the pieces in a word, and each word in a set has a different marking.

Procedure. It was explained to the S that long words are composed of smaller, easier-to-read parts. He was then given the pieces to three words at a time, and requested to make three words from them, read each word, and write it out. If he failed to

comprehend the sorting guide on his own, his attention was directed to it. A point was given for each word read and written correctly. When the S had finished all 48 words, he started over at the beginning.

SS

Materials. The syllables of the long words in the PRK2 were each printed on small squares of foolscap.

Procedure. The same explanation about long words being composed of small parts was made first. The pieces to one word at a time were then placed before the S, in a mixed-up order, and he was asked to rearrange the pieces to make a real word, and to read and write out that word. Only one word at a time was given because there were no clues to the correct order. Also, the S was provided with some assistance in rearranging the pieces when he had difficulty, but in doing so, the E never pronounced the syllables for him. Again, one point was given for each word read and written correctly.

APPENDIX B

Lists of Words Corresponding to Errors A, B, and CList A

- | | | |
|--------------|--------------|--------------|
| 1. prayer | 18. furnish | 35. gage |
| 2. announce | 19. skate | 36. thunder |
| 3. polite | 20. coward | 37. afraid |
| 4. narrow | 21. supply | 38. plough |
| 5. noodle | 22. loon | 39. grind |
| 6. daughter | 23. crook | 40. dough |
| 7. beneath | 24. sought | 41. due |
| 8. phonics | 25. pasture | 42. dawn |
| 9. thirst | 26. slicing | 43. nation |
| 10. flame | 27. expert | 44. judge |
| 11. browse | 28. trail | 45. flurry |
| 12. delight | 29. boundary | 46. growl |
| 13. oppose | 30. dried | 47. umpire |
| 14. screw | 31. slower | 48. naughty |
| 15. shawl | 32. cure | 49. jewel |
| 16. brief | 33. install | 50. practice |
| 17. threaten | 34. mission | |

List B

- | | | |
|----------------|----------------|-------------------|
| 1. excellent | 18. organize | 35. elephant |
| 2. photograph | 19. criminal | 36. tomato |
| 3. relative | 20. prettiness | 37. seventeen |
| 4. evidence | 21. buffalo | 38. locomotive |
| 5. cavity | 22. attempting | 39. voluntary |
| 6. material | 23. magazine | 40. development |
| 7. department | 24. adjective | 41. investigate |
| 8. satisfy | 25. settlement | 42. expensive |
| 9. ordinary | 26. kangaroo | 43. permanently |
| 10. hospital | 27. military | 44. operator |
| 11. paragraph | 28. magnetic | 45. remodelling |
| 12. portable | 29. cabinet | 46. generally |
| 13. transistor | 30. apartment | 47. embarrassment |
| 14. recorded | 31. cigarette | 48. delivering |
| 15. consider | 32. umbrella | 49. asparagus |
| 16. uniform | 33. successful | 50. identify |
| 17. factory | 34. dignified | |

List C

- | | | |
|---------------|--------------|-------------|
| 1. discard | 18. plume | 35. scrap |
| 2. quite | 19. attract | 36. humane |
| 3. purred | 20. lifeless | 37. flatter |
| 4. aware | 21. canned | 38. chimp |
| 5. sack | 22. change | 39. chase |
| 6. deflate | 23. dinner | 40. twist |
| 7. swindle | 24. finest | 41. reduce |
| 8. sales | 25. finished | 42. static |
| 9. pal | 26. diner | 43. pale |
| 10. statement | 27. plump | 44. salad |
| 11. conduct | 28. escape | 45. swine |
| 12. twice | 29. arrest | 46. sake |
| 13. casket | 30. crane | 47. awards |
| 14. arise | 31. chant | 48. pure |
| 15. human | 32. trace | 49. quick |
| 16. chime | 33. lifting | 50. cared |
| 17. stall | 34. stale | |

APPENDIX C

Description of the Reading and Intelligence Tests Used

SIRI-A

The full SIRI-A is composed of eight graded lists of 20 words each, for oral reading. Following this, there are eight graded paragraphs to be read orally, each followed by comprehension questions. These questions were read to the child and he was requested to answer them from memory. The full test was administered only in the initial assessment prior to training (i.e. Test Period A). Subsequently, the SS were given only the lists of graded words.

Reading Portion (Level I) of the WRAT

This was designed for children aged 5 yr. 0 mo. to 11 yr. 11 mo. It is composed of 25 letters and 75 words, arranged in order of increasing difficulty. The SS began the test at the first word and were given credit for the preceding letters. The split-half reliability coefficients for ages 7 and 8 are 0.991 and 0.993, respectively.

WISC Subtests

Comprehension consists of questions pertaining to social and moral aspects of daily life situations (e.g. "What is the thing to do if a fellow much

smaller than yourself starts to fight with you?"). Similarities requires the child first to complete analogies (e.g. "Boys grow up to be men and girls to be _____.") and then to state in what way pairs of items (e.g. a piano and a violin) are alike. Vocabulary requires the child to give the meaning of various words (e.g. donkey, microscope). Block Design presents the child with red and white designs in a booklet, to be copied with a set of red and white blocks. The split-half reliability coefficients for the four subtests, at age $7\frac{1}{2}$ are: Comprehension--0.59, Similarities--0.66, Vocabulary--0.77, and Block Design--0.84.

APPENDIX D

Sample Letter to Teachers and Parents

Dear _____.

S is trying very hard in his reading lessons and is making good progress. He has earned five more stickers, on the following days:

May 21 - - - - - 2

May 22 - - - - - 1

May 24 - - - - - 2

So far, S has earned a total of 15 stickers and has learned to read many new words.

Yours sincerely,

(Mrs.) R. Mallenby