

THE UNIVERSITY OF MANITOBA

EFFECTS OF TOKEN REINFORCEMENT  
UPON READING COMPREHENSION AND GENERALIZATION  
WITH IMMIGRANT CHILDREN IN A NORMAL CLASSROOM

by

L. Craig Turner

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## ABSTRACT

Two recently immigrated children were involved in a program to increase reading comprehension. During each session the students were asked to read a specified amount of material orally and then to answer questions about the material. Following two baseline phases token reinforcement was introduced in a modified multiple baseline design across subjects and across three books. Results showed a sharp increase in the percent of correct answers to the comprehension questions and a decrease in the number of reading errors. During follow-up phases, reinforcement for each student was gradually reduced to zero for one of their three books, with no reinforcement at all being given for the other two books. The percent of correct answers to the comprehension questions remained very high across all three books; however, the number of reading errors increased slightly towards original baseline levels.

Throughout all experimental phases generalization probes were conducted across settings (i.e., from session room to home classroom) and across trainers (i.e., from experimenter to home-room teacher) for the reading comprehension behavior. Results showed that the behavior generalized well in that the generalization data were comparable to the regular session data. In addition to the number of questions answered correctly and material read correctly, several measures were taken on passages written by the students upon completion of each of the three books. No contingencies were placed on this behavior. Results showed a wide degree of fluctuation with no clear effect as a function of the experimental phases.

Prior to the commencement of the study both students scored an

average of two years below their grade level on a reading and reading comprehension test. When this test was conducted at the completion of the study, each student showed an increase of approximately four grade levels. Other results add support to the effectiveness of token reinforcement in increasing reading comprehension behavior plus presenting information on possible parameters of generalization of this behavior.

## ACKNOWLEDGEMENT

I would like to take this opportunity to thank my Advisor, Dr. Joseph J. Pear and my other committee members Dr. Garry L. Martin and Dr. Glen H. Lowther who offered me their continual support and advice over the past several years and to their constant encouragement during this study. The research study would not have been possible without the support and consent of Mr. Bob Millman, principal of Darwin School; the two home-room teachers, Mrs. Pat Wilkins and Mrs. Linda Smyrichinski who unselfishly gave me their time, and to the Resource Teacher, Mrs. Henderson, who was always around when I needed her.

Special thanks must go to Barb Roscoe whose magic typing fingers and knowledge of bureaucratic red tape made all this possible.

Finally, but most importantly, I dedicate this thesis to George and Nick. Their love of life and freedom was so contagious I never thought of this research as being work. I wish you both all the best in your new life in a new land.

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## INTRODUCTION

The systematic manipulation of teacher attention appears to have been the first behavioral technique used in the school (Zimmerman, & Zimmerman, 1962). Teacher attention has been applied to small classes (e.g., Zimmerman & Zimmerman, 1962) and large classes (e.g., Hall, Lund & Jackson, 1968). Within the classroom setting teacher attention has been applied to one student (e.g., Kirby & Shields, 1972), as well as to the whole class (e.g., Madsen, Becker, Thomas, Koser & Plager, 1968). As well, teacher attention has also been applied to different age groups such as kindergartens (e.g., Schutte & Hopkins, 1970) and high schools (e.g., McAllister, Stachowiak, Baer & Conderman, 1969).

Research on teacher attention has usually combined the praising of appropriate behaviors and the ignoring of inappropriate behaviors. However, Madsen, Becker and Thomas (1968) studied praising and ignoring separately and found that ignoring inappropriate behaviors was not effective by itself in producing consistent acceptable behavior change. A few years later, Kirby and Shields (1972) discovered that children's attending behavior increased and decreased depending on whether the teacher's praise, contingent on appropriate behaviors, was instituted or withdrawn.

Still later, emphasis on training the teacher to train the child changed direction. Now behaviorists were more interested in directly training the student. The area of self-control or self-management became very popular.

Self-management can be divided into different categories. It usually includes one or more of the following: (1) self-determination of goals and reinforcement standards; (2) self-recording; (3) self-evaluation; and (4) self-reinforcement. Numerous programs which have used more than one of

these categories have been quite successful (e.g., Bandura & Perloff, 1967; Felixbrod, 1974; Felixbrod & O'Leary, 1973, 1974; Glynn, 1970; Lovitt & Curtiss, 1969; Turkewitz, O'Leary & Ironsmith, 1975). But not all categories by themselves have been successful. Santogrossi (1974) found self-recording to be an ineffective procedure by itself, while Santogrossi, O'Leary, Romanczyk, and Kaufman (1973) and Turkewitz et al. (1975) found self-evaluation also to be an ineffective procedure by itself in producing appropriate behavior change.

Early behavior modification programs in the school often used tangible reinforcers such as candy or money. As time went on, not only did the problems studied by behaviorists become more sophisticated and complex but so did the reinforcement systems. Along with this development behaviorists moved directly into the midst of a growing controversy over reward programs. The controversy developed not because of the effectiveness of reward programs but because of the type of reinforcement used.

Reward programs have used various reinforcers such as money, praise, feedback, tokens, etc., and generally the results showed that when reinforcement was made contingent upon specific behaviors, these behaviors increased in frequency. However, some programs which used specific types of reinforcers had conflicting results. Kuypers, Becker and O'Leary (1968) found that not all their subjects responded equally well to token reinforcement, whereas other researchers (e.g., Graubard, 1969; Harris & Sherman, 1973) found good results with this type of reinforcement system. Eventually, some researchers began to suggest that not only do some subjects not respond well to token reinforcement but they may also develop other problems such as reduced levels of interest and/or poor generalization to the natural environment (e.g., Deci,

1971, 1972; Lepper, Greene & Nesbitt, 1973). Meichenbaum, Bowers, and Ross (1968) and O'Leary, Becker, Evans, and Saudgras (1969) found that if a token reinforcement program was used during one part of the school day and not during other parts, students discriminated the intervention and non-intervention phases, which decreased the likelihood of generalization. What this meant was that the increase in academic and/or social behaviors during the token phases was not maintained during the non-token phases. Levine and Fasnacht (1974) stated that although the immediate effects of token programs may be positive, they felt that these could do more harm than good. They suggested that there should not be an attempt to use extrinsic rewards for behaviors that are of some intrinsic interest, such as classroom activities, but instead we "should first search for the natural reinforcers of problem behaviors as a significant point of intervention". Levine and Fasnacht conceded that immediate results of token systems will probably show an increase in learning but that long range results will indicate that token rewards had lead to a decrease in interest. They also felt that there was little acceptable evidence to show that generalization occurs with token programs. Finally, once token reinforcement was removed, they also felt that natural reinforcers generally did not take control over the desired behaviors.

The studies which have used token reinforcement have been numerous but they generally can be classified into three groups. The first group consists of studies which focused on one student receiving reinforcement for contingent behavior with the entire class sharing in the rewards (e.g., Brooks & Snow, 1972; Carlson, Arnold, Becker & Madsen, 1968; Coleman, 1970; Evans & Oswalt, 1968; Patterson, 1965; Rosenbaum, O'Leary & Jacob, 1975). The second group consists of studies which focused on only one student

receiving reinforcement but the behavior of the entire class was considered prior to awarding the reinforcement (e.g., Ascare & Axelrod, 1973; Barrish, Saunders & Wolf, 1969; Grandy, Madsen & DeMersseman, 1973; Harris & Sherman, 1973). The third group consists of studies which focused on the entire class receiving reinforcement (e.g., Schmidt & Ulrich, 1969; Wilson & Hopkins, 1973).

Despite the recent trend in reward programs towards the use of natural reinforcers (O'Leary & O'Leary, 1976), the concern about generalization continues. One of the most frequently used methods to facilitate generalization has been fading. This method may involve gradually decreasing the rate of reinforcement (e.g., O'Leary & Becker, 1967); gradually decreasing the number of daily reports sent home from school (e.g., Bailey, Wolf & Phillips, 1970); or gradually decreasing teacher monitoring and back-up reinforcers (e.g., Turkewitz et al., 1975). Another approach has been to program certain aspects of the treatment procedures directly into the subject's post-treatment environment (e.g., Walker & Buckley, 1972). Still another technique has been to employ feedback in the post-treatment environment in an attempt to maintain behavior (e.g., Drabman, 1973). Stokes and Baer (1977) state that a majority of behavioral researchers failed to program for generalization and instead used what the authors called a "train and hope" procedure where the behavioral researchers hoped that once appropriate behaviors had been trained, they would generalize. Stokes and Baer add that even if generalization was a possibility, a large majority of researchers failed to even determine if generalization had indeed occurred. One of their recommendations was that generalization should not be expected to occur automatically, but instead requires direct programming.

While this controversy over the use of certain reward programs continued, behaviorists also continued to expand the range of behaviors investigated. Specific behaviors studied included spelling (e.g., Rapport & Bostow, 1976), mathematics (e.g., Van Houten & Thompson, 1976), composition writing (e.g., Brigham, Graubard & Stans, 1972; Van Houten, Morrison, Jarvis & McDonald, 1974), and reading comprehension (e.g., Knapczyk & Livingston, 1974; Lahey, McNees & Brown, 1973).

Of these new areas being studied, one of the most interesting is reading comprehension. Knapczk and Livingston(1974) studied the effects of prompting question asking upon on-task and reading comprehension behaviors. The results showed that prompting was effective in initiating question asking as well as in increasing levels of reading comprehension and on-task behaviors. Lahey et al. (1973) studied reading comprehension directly with token reinforcement contingent on correct answers to comprehension questions. The authors reported a sharp increase in comprehension behavior when training was in effect. The two principal students who had previously scored at the C to F level in reading comprehension increased their comprehension skills to an A to B level. However, despite the favourable results of both these studies in increasing reading comprehension, neither attempted to take any generalization measures. Lahey et al. (1973) had no generalization data taken in the students' classrooms because all sessions were conducted in an experimental room; also there was no generalization data taken with the home-room teacher since there was only one main experimenter in the study. The authors point out in their conclusions that these types of generalization measures are very necessary and any further research in this area must consider them.

One purpose of this study was to attempt a replication of the Lahey et al.

(1973) study. Another purpose was to take generalization measures both across different settings (i.e., from session room to classroom) and across different trainers (i.e., from experimenter to home-room teacher). In addition to this research concern about token reinforcement programs and generalization there was also a practical consideration involved in the present research. The two subjects of this study were immigrant children who were having difficulty in school due to their inadequate reading comprehension skills.

#### METHOD

##### Subjects

Two brothers, 10 and 11 years old served as subjects for this study. The brothers had immigrated from Romania six months prior to the study and were enrolled in a normal school in Winnipeg. Student 1 was the 11 year old boy and he was enrolled in the fourth grade. Student 2 was the 10 year old boy and he was enrolled in the third grade. Prior to the start of the study, the students' reading and reading comprehension skills were tested on the Metropolitan Achievement Test (Durost, Bixler, Wrightstone, Prescott, & Balow, 1971). When their test scores were compared to the grade levels they were enrolled in, Student 1 was two years and three months below the expected level, while Student 2 was one year and five months below the expected level.

##### Setting

The experimental sessions were conducted in a seminar room located in the school library section. The room measured 3 m by 6 m and was equipped with a table, two chairs, and a blackboard and pegboard hanging on adjacent walls. The home-room classrooms of the two students served as the setting for the generalization probes.

##### Materials

Three books were used in this study. They were chosen from a 20-book

series from the Bodley Head Publishing Company. When the subjects were questioned on what they knew about the topics covered in these books, they stated that they were not familiar with any of the topics but they were anxious to learn. The books were The Curious World of Snakes by Alfred Leutscher (Book A); Animals of the Antarctic by F.D. Ommanney (Book B); and Animals of the Desert by J.D. Cloudsley-Thompson (Book C). The format of books were almost identical with the same number of pages, and the same number of topics throughout.

The books were located in the third and fourth grade sections of the school library. The home-room teachers and the school resource teacher felt that this was the appropriate level of difficulty to begin reading with the students.

#### General Procedures

There was a total of five experimental phases per book in this study. The phases were as follows: (1) pre-baseline; (2) baseline 1; (3) baseline 2; (4) training; and (5) follow-up. The intent of the pre-baseline phase was to take a measure of the students' knowledge about the topics to be covered in these three books prior to any actual contact. The students were therefore asked to each write one passage on each of the three books specifying what they knew about these topics. The other four experimental phases incorporated this same measuring device; however, the students had then read the books.

Individual sessions were conducted four days a week, twice a day, with each session lasting approximately 30 minutes. During each session the students were asked to read a specified amount of material in one of the books and they were then asked comprehension questions covering the material just read. They were asked to write out their answers for each question.

(See Appendix A for a list of the comprehension questions.)

Throughout all phases after pre-baseline, the percent of correct answers were recorded. During the two baseline phases correct answers were not reinforced while in the training phase correct answers did produce token reinforcement. The students worked on only one book at a time, reading them in different sequences (see next section for specific details). Each time a student finished reading a book he was asked to write a passage on that book and the other two.

The second form of daily sessional data besides the percent of correct answers to the comprehension questions was on the student's reading of the book. The book had been divided into blocks of two sentences and the experimenter recorded a correct or incorrect response for each block of sentences read.

#### Specific Procedures

The experimental procedure was a modified multiple baseline design (Baer, Wolf, & Risley, 1968) across books and across students. As was mentioned, the two students read the books in a different sequence. Student 1 read Books C, A, and B, while Student 2 read Books A, B, and C in that order. This was done to help alleviate any order effects. The experimental design incorporated five separate phases.

Pre-baseline. Prior to any contact with the books, each student was asked to write a passage on each of the three books. They were told that they had a 10-minute time limit for each passage and they were to write down everything they knew about the book's topic. Throughout this phase and remaining phases, no assistance was given to the students when writing the passages. Also, the 10-minute time limit was kept constant throughout the study.

Baseline 1. Both students read each of the three books one at a time.

A new book was not introduced until reading of the previous one had been completed. At the end of each session the student was asked the questions covering the material just read. The percent of correct answers was recorded.

The second form of data collection was on the correct or incorrect reading of the book material. Incorrect reading was defined as substituting one word for another or leaving out one or more words. The book material had been divided into blocks of two sentences and each block was recorded as being correctly or incorrectly read. Students were not penalized for incorrect pronunciation which was easily distinguishable from the substitution of a word.

Baseline 2. After all three books had been read once in Baseline 1 the student returned to his first book and the same procedures as in Baseline 1 were replicated.

Training. This phase was the first introduced immediately after completion of Baseline 2 for the student's first book. The procedures in Baselines 1 and 2 were replicated, but now the student received one token for every two blocks of two sentences mastered and one token for every comprehension question answered correctly. After completion of training on the first book, each student returned to Baseline 2 for the second book. Training was introduced for this book immediately after completion of Baseline 2. The third book followed the identical procedure after training on the second book had been completed. Again, as in previous phases, after completion of a book the student was required to write one passage on each of the three books.

During training the students were given plastic chips which could be cashed in for one of three reinforcers (i.e., free time in the gym, one-half hour drive with the experimenter, and a one-hour swim with the experimenter at a public pool). These three reinforcers were picked by the students and

ranked in terms of value. Generally each student was able to cash in on these reinforcers two to three times per training phase.

Follow-up. This phase was introduced for each student after they had completed training on all three books. Reinforcement was gradually faded out for the first book of each student. Session 1 had half the reinforcement as in training: two correct answers on the comprehension test produced one token, while every four blocks of two-sentence material read correctly produced one token. In Session 2, two correct answers on the comprehension test produced one token, while no tokens were given for correct reading of the book. In Session 3, four correct answers produced one token, while in Session 4, eight correct answers produced one token. In Session 5 there were no tokens.

For the remaining two books neither the students' correct answers to the comprehension test nor correct reading of the book produced any tokens.

Generalization probes. A total of 45 generalization probes were conducted across settings and experimenters. The generalization probe across settings involved the experimenter conducting the reading comprehension test in the classroom setting (i.e., each student's home room). The generalization probe across testers involved the student's home-room teacher conducting the comprehension test in the classroom setting.

#### Dependent Variables

There were five categories of dependent variables recorded at various intervals throughout the study. They were as follows: (1) reading comprehension; (2) quality of descriptive and factual information in the passages; (3) quantity of writing; (4) teachers' ranking of descriptive and factual information in the passages; and (5) teachers' subjective measure test.

Reading comprehension test. At the end of each session the students were

asked the questions covering the material just read and the number of correct answers was recorded. These same questions were again asked in subsequent readings of the three books. Two types of generalization probes were conducted on this test with one measuring generalization across settings from the session room to the classroom, and the other measuring generalization from the original experimenter to the student's home-room teacher.

Quality of descriptive and factual information in passages. This and the next two categories of dependent variables were used to analyze the passages written by the two students. This category consisted of three of the classification measures developed by Brigham, Graubard, and Stans (1972) which they felt measured the quality of composition writing. These measures were: (1) mechanical aspects such as length, spelling, grammar, and punctuation; (2) number of ideas; and (3) development of ideas. Each of these three measures was scored from 0 to 5 (in whole numbers) for all 78 passages written during the study. To ensure consistency between observers (i.e., observer and experimenter) sample passages were randomly chosen and used as training examples for the two observers. Rudimentary definitions were developed for these three categories and with the sample passages observers judged and discussed until there was agreement on scoring each dimension. All the passages written by the students had been typed exactly the way they were written with no identifying marks. The order in which the passages had been written was randomized to prevent the observers from knowing when they were written.

Quantity of writing. This category utilized two classification measures from Van Houten, Hill, and Parsons (1975). These composition measures were: (1) total number of words written; and (2) total number of different words. Again, the observers judged and discussed examples of these measures until

agreement was reached on scoring both measures.

Teachers' rankings of descriptive and factual information in the passages. For this category the last passage written during each of the five experimental phases was used. Four elementary school teachers (including the two home-room teachers) were given the three piles of passages corresponding to each of the three books. The passages were randomized to alleviate order effects. In this test the teachers were asked to rank the passages from 1 to 5, with 5 representing the most informative and knowledgeable passage and 1 representing the least. The two fourth grade teachers scored Student 1's passages while the two third grade teachers scored Student 2's passages. The teachers were asked to use their own means for marking papers and to rate these passages as they would rate one of their own students. The teachers worked only on the passages from one book at a time, and were blind as to the design and the intent of this study.

Teachers' subjective measure test. This final test was an attempt to have the two home-room teachers rate their student's knowledge of the three books. The test required the teacher to spend some time with her student on a random basis asking him questions about what he had been reading with the experimenter. The teacher was free to ask any questions and from the student's answers she would rank the topics discussed in the order which she felt represented the student's level of knowledge. Post-hoc comparisons were then made of the teacher's results to the experimental phases of the study.

### Reliability

For the reading comprehension data, a naive observer was given the data from three of the sessions in each of the five experimental phases. The student's answers had been typed exactly the way they were written. The observer received a copy of the questions, the answer key, the student's

answers, and the books. He was asked to grade the answers as either correct or incorrect. Interobserver reliability was calculated by dividing the number of agreements by agreements plus disagreements, and multiplying by 100.

The reliability for the first two measures on the passages (i.e., quality of descriptive and factual information, and quantity of writing) incorporated a sample of the total 78 passages written. After an observer had scored all 78 passages (once the definitions and scoring measures had been judged and discussed with the experimenter) a second observer picked 10 passages, five from each student. The only instructions this second observer received was to ensure that all three books were represented by at least one passage for each student. The experimenter was then given these passages, unaware as to which subject wrote them and as to which experimental phase they were written in. The experimenter's results were then compared to the first observer's scores on these 10 passages. Again the reliability was calculated by dividing the number of agreements by agreements plus disagreements, and multiplying by 100. Reliability measures were not taken on the other two dependent measures.

#### RESULTS

Reliability measures for reading comprehension was 96% for both students (range 92% to 100%). The average of the two reliability measures on the dependent variables was 83% for Student 1 (range 76% to 100%), and 86% for Student 2 (range 73% to 100%).

Figure 1 presents the reading comprehension data for Student 1.

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Insert Figure 1 about here  
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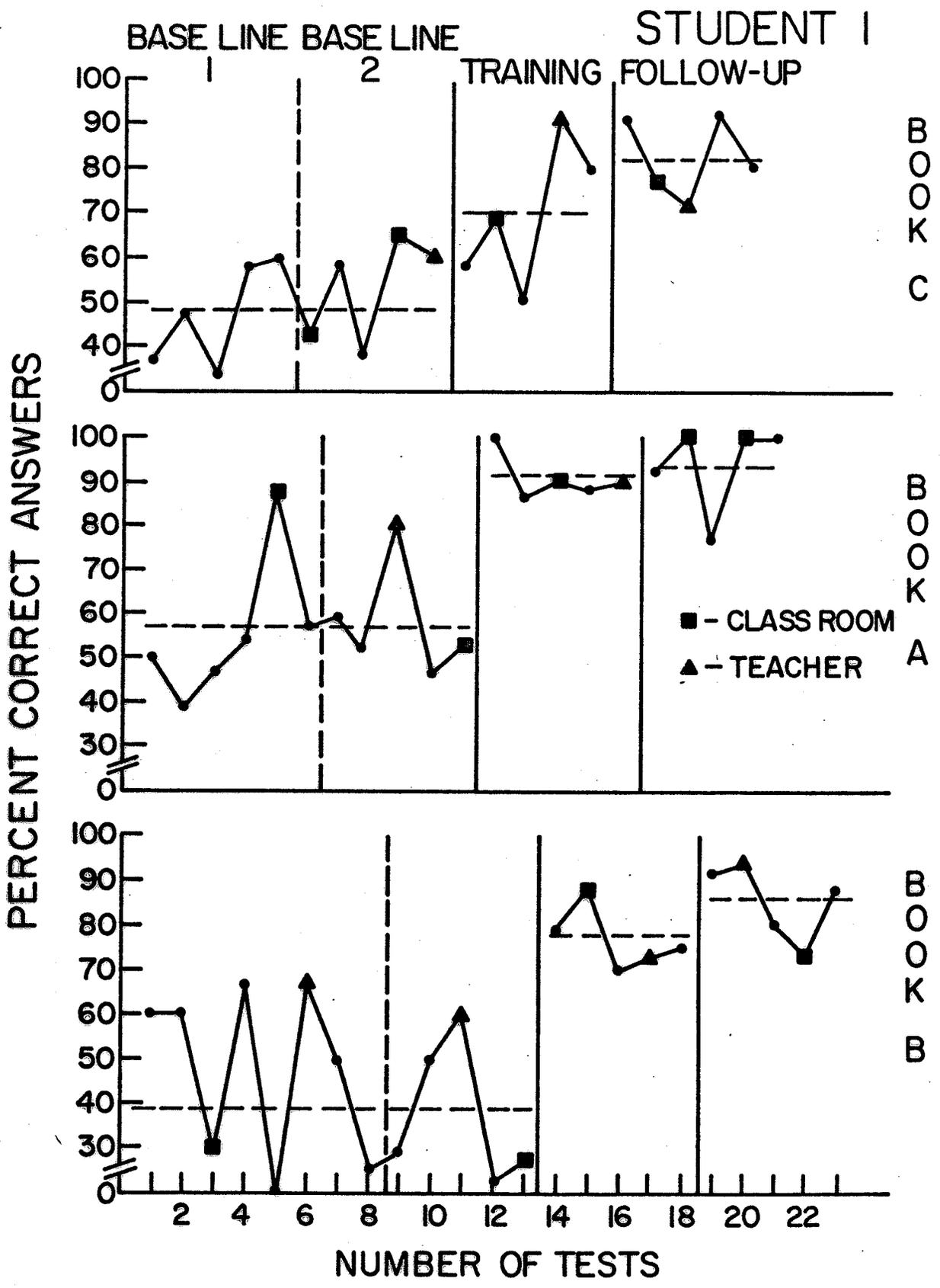


Figure 1. Mean percent correct answers to the reading comprehension questions for Student 1.

The mean percentage of correct answers for the two baseline phases for Book C was 48% which then rose to 70% during the training phase. The average baseline scores for Book A was 57%. During training the level rose dramatically to 91%. The last book, Book B, had an average baseline score of 39% which then rose to 77% during training. In the follow-up phases the mean percentage of correct answers increased slightly for all three books with scores of 82%, 93%, and 86% for Books C, A, and B, respectively. The generalization probes across testers and across settings showed consistent and similar levels with the regular session data.

Student 2's comprehension data can be seen in Figure 2. The results

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 Insert Figure 2 about here  
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were quite similar to those of the other student. The mean percentage level of correct answers for the two baseline phases in Book A were 62%. The level during training rose quickly to 84%. Book B had an average of 53% during baseline and a high level of 88% during training. The last book, Book C, had an average score of 65% during baseline and 86% during training. Again, the percentage levels remained high during follow-up with scores of 75%, 85%, and 89% for Books A, B, and C, respectively. The generalization probes for Student 2 showed similar patterns to the other student with consistent levels to the regular session data.

The effects of token reinforcement on the reading errors of the two students can be seen in Figure 3. Student 1 had a total of 31 reading errors

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 Insert Figure 3 about here  
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across all three books from baseline scores to the training scores with

# STUDENT 2

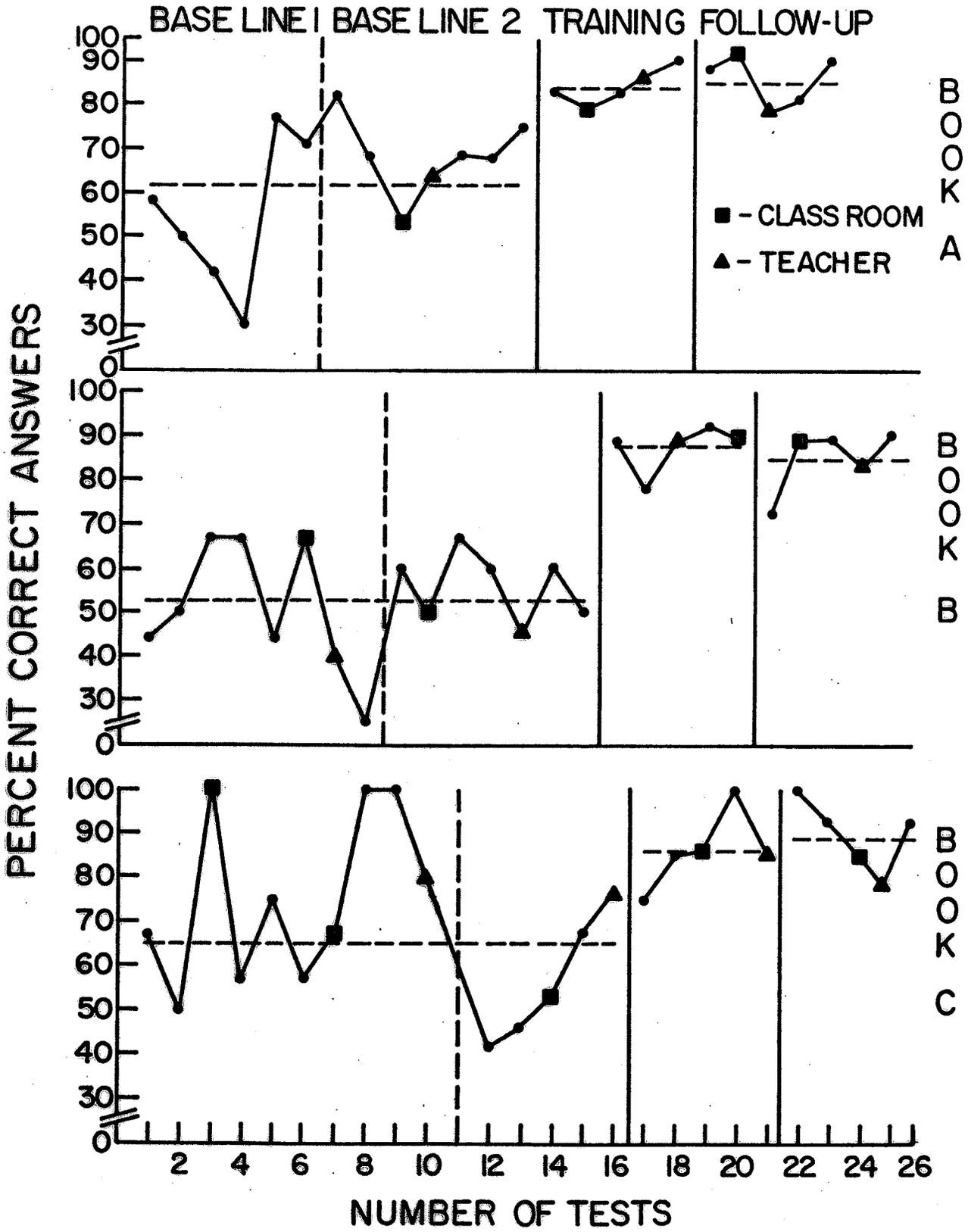


Figure 2. Mean percent correct answers to the reading comprehension questions for Student 2.

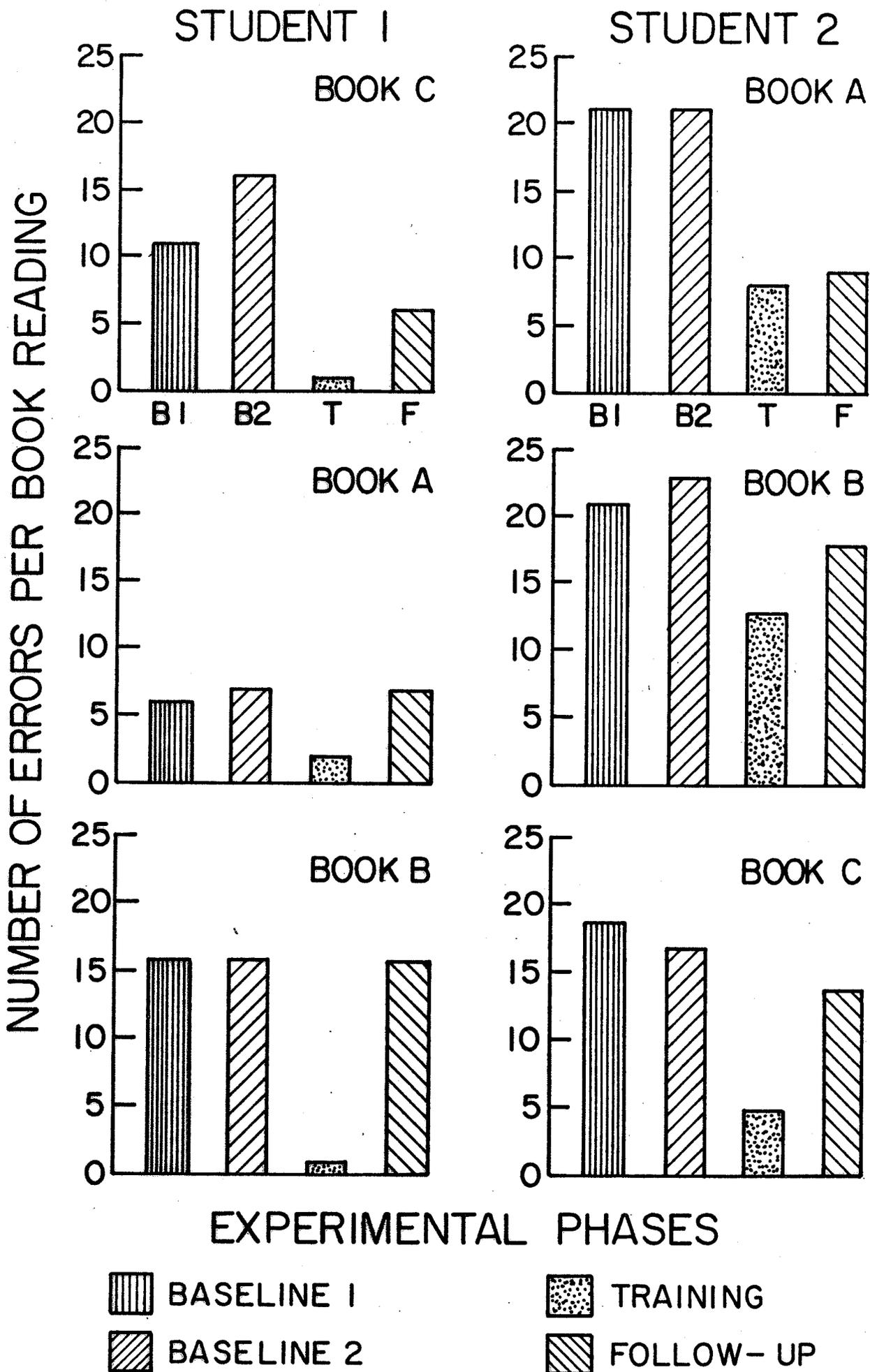


Figure 3. Number of reading errors for Student 1 and Student 2 across experimental phases

the biggest reduction appearing in Book C with 15 errors. The number of errors during follow-up showed a return to original baseline levels in Books B and C and a level on only one-half of the baseline scores in Book A. Student 2 showed similar results with a total reduction of 35 reading errors from baseline scores to training scores. Books A and C both had the largest reduction in errors with 13 while Book B had a reduction of 9 errors. Unlike the case with Student 1, however, none of the error levels during the follow-up for Student 2 returned to their original baseline levels, although Books B and C had only four errors below baseline level. As for Book A, there was an increase of only one error from training to follow-up.

Table 1 depicts two of the dependent variables and their measurements

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 Insert Table 1 about here  
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of the indirect effects of the experimental phases upon writing behavior. Both the quality (as measured by spelling, grammar, number of ideas, and development of ideas) and the quantity (as measured by number of words and number of different words) of the 78 passages varied a great deal. Not only did the within-experimental phase analysis show no consistency but also there was no consistency across phases either. The classification measures fluctuated greatly; sometimes passages rated as the best quality appeared during the second baseline (as in Book A for Student 1) or in training (as in Book B for Student 2). As for measures of quantity the most written words appeared during the first baseline (as in Book C for Student 1) or in training (as in Book B for Student 2).

The third dependent variable analyzing the passages involved the four elementary school teachers and their rankings of the passages. As can be

Table 1  
 Measures of Quality of Descriptive and Factual Information  
 And Quantity of Writing for Passages by Student 1 and Student 2  
 Across Experimental Phases

		Student 1					Student 2					
		Mechanical Aspects	Number of Ideas	Development of Ideas	Number of Words	Number of Different Words	Mechanical Aspects	Number of Ideas	Development of Ideas	Number of Words	Number of Different Words	
Pre-Baseline	Book C	3	1	1	6	6	Book A	5	1	5	26	19
	Book A	1	5	3	44	35	Book B	2	2	3	34	28
	Book B	1	2	3	39	27	Book C	5	1	5	12	11
Baseline One	Book C	4	5	4	118	63	Book A	1	3	5	105	55
	Book A	4	5	1	8	8	Book B	3	3	5	34	42
	Book B	1	5	3	84	46	Book C	2	3	5	67	42
Baseline Two	Book C	1	4	4	43	29	Book A	2	1	5	40	27
	Book A	4	3	5	45	28	Book B	1	1	5	47	31
	Book B	1	5	4	108	64	Book C	3	1	5	21	20
Training	Book C	2	4	3	31	20	Book A	1	4	4	45	27
	Book A	2	5	2	71	38	Book B	1	5	5	125	66
	Book B	2	4	5	43	33	Book C	1	4	4	79	55
Follow-up	Book C	1	5	3	101	67	Book A	1	2	3	62	39
	Book A	1	5	4	54	40	Book B	1	3	4	37	22
	Book B	1	5	4	100	60	Book C	1	3	4	59	38

seen in Table 2, the 15 passages were ranked in terms of the level of

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 Insert Table 2 about here  
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information and knowledge as defined by the teachers. Student 1 had only one of the passages in the training phase ranked as the best (i.e., Book C) while the passages in the second baseline and the first baseline phases were the best for Books A and B, respectively. The other student also had only one of the passages in the training phase ranked as the best (i.e., Book B) while the passages in the follow-up phases were ranked the best for both Books A and C.

Table 3 shows the subjective rankings of topics by the two home-room

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 Insert Table 3 about here  
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teachers during discussion sessions with their student. Again, the experimental phases appeared to have little direct effect on the topics discussed and generally the one picked first was the book currently being read. Both students had two exceptions to this trend (i.e., Sessions 1 and 3 for Student 1, and Sessions 1 and 5 for Student 2).

The pre- and post-test scores of the Metropolitan Achievement Test (Durost et al., 1971) are depicted in Table 4. At the start of this study the scores were

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 Insert Table 4 about here  
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compared to each student's current grade placement. They both scored an average of two years below their grade level. When the test was conducted at the

Table 2

Teachers' Rankings of Descriptive and Factual Information  
For Passages by Student 1 and Student 2

	Book	Phases	(Home Room)	
			Teacher #1	Teacher #2
Student 1	Desert (Book C)	Pre-Baseline	4	1
		Baseline One	2	5
		Baseline Two	1	3
		Training	5	2
		Follow-up	3	4
	Snakes (Book A)	Pre-Baseline	1	1
		Baseline One	3	5
		Baseline Two	5	3
		Training	2	2
		Follow-up	4	4
	Antarctic (Book B)	Pre-Baseline	1	3
		Baseline One	5	2
		Baseline Two	3	5
		Training	2	1
		Follow-up	4	4
Student 2	Snakes (Book A)	Pre-Baseline	1	1
		Baseline One	4	5
		Baseline Two	2	2
		Training	3	3
		Follow-up	5	4
	Antarctic (Book B)	Pre-Baseline	2	3
		Baseline One	4	4
		Baseline Two	3	2
		Training	5	5
		Follow-up	1	1
	Desert (Book C)	Pre-Baseline	1	1
		Baseline One	4	4
		Baseline Two	2	2
		Training	3	5
		Follow-up	5	3

Table 3

Home-room Teachers' Subjective Rankings  
Of Topics Discussed with Student 1 and Student 2

	Session	Phase	Ranking of Books
Student 1	1	Baseline 1 (Antarctic)	1) Snakes 2) Antarctic 3) Desert
	2	Training (Desert)	1) Antarctic
	3	Baseline 2 (Antarctic)	1) Antarctic
	4	Training (Antarctic)	1) Antarctic
	5	Training (Antarctic)	1) Antarctic
	6	Finished	1) Snakes
Student 2	1	Baseline 1 (Desert)	1) Antarctic 2) Snakes
	2	Baseline 1 (Desert)	1) Desert
	3	Baseline 2 (Antarctic)	1) Antarctic
	4	Training (Antarctic)	1) Antarctic
	5	Baseline 2 (Desert)	1) Antarctic
	6	Follow-up (Antarctic)	1) Antarctic
	7	Finished	1) Antarctic

Table 4

Pre- and Post-test Scores of Metropolitan Achievement Test (Durost et al., 1971)

	Standard Score	Grade Equivalent		Standard Score	Grade Equivalent
<u>STUDENT 1</u> <u>(Primary I)</u>			<u>STUDENT 1</u> <u>(Primary II)</u>		
1. Word Knowledge	52	2.5	1. Word Knowledge	70	
2. Word Analysis	48	2.45	2. Reading (Part A)	86	(Beyond scale)
3. Reading	55	2.8	3. Reading (Part B)		
4. Word Knowledge & Reading	60	3.4	<u>(Elementary)</u>		
	(Average)	3.0	1. Word Knowledge	68	4.2
<u>(Primary II)</u>			2. Reading	86	(Beyond scale)
1. Word Knowledge	50	2.4	<u>(Intermediate)</u>		
2. Reading (Part A)	56	2.9	1. Reading	84	Above 7.0
3. Reading (Part B)			Average (Word Knowledge & Reading)		6.3
	(Average)	2.65			
<u>STUDENT 2</u> <u>(Primary I)</u>			<u>STUDENT 2</u> <u>(Primary II)</u>		
1. Word Knowledge	47	2.2	1. Word Knowledge	61	
2. Word Analysis	54	3.0	2. Reading (Part A)	70	(Beyond scale)
3. Reading	50	2.4	3. Reading (Part B)		
4. Word Knowledge & Reading	47	2.25	<u>(Elementary)</u>		
	(Average)	2.4	1. Word Knowledge	68	4.2
<u>(Primary II)</u>			2. Reading	69	(Beyond scale)
1. Word Knowledge	50	2.4	<u>(Intermediate)</u>		
2. Reading (Part A)	56	2.9	1. Reading		6.1
3. Reading (Part B)			Average (Word Knowledge & Reading)		5.2
	(Average)	2.65			

completion of the study both showed an increase of approximately four grade levels. Student 1 had a minimum average grade level of 6 years 3 months with the reading comprehension subtest having a score beyond the 7 year grade level. Student 2 had an average grade level of 5 years 2 months with the reading comprehension subtest having a score of 6 years 1 month.

#### DISCUSSION

Lahey et al. (1973) reported that prior to their study the behavioral literature had shown no clear conclusions on the modifiability of reading comprehension behavior. Their results demonstrated that this type of behavior could indeed be improved by the use of contingent token reinforcement. The results in this study displayed in Figures 1 and 2 are an excellent replication of their findings. In addition, this study adds quite a bit more information to that of Lahey et al. (1973). First of all, data were also obtained on the number of reading errors. This information adds more validity to the control of the token reinforcement program. There were dramatic decreases in errors from baseline scores to training showing the effects of the training program. Also, since the level of errors either remained constant or increased from Baseline 1 to Baseline 2 for five of the possible six occurrences (i.e., 2 students x 3 books) the possibility that the results are due merely to a practice effect over subsequent readings of the books is weakened considerably.

A second bit of information from Lahey et al. (1973) deals with the generalization probes. These authors in their conclusion stated that their study had not measured generalization and suggested that further research concentrate on this area. The data from the generalization probes showed that generalization did occur across settings and across trainers. The

generalization results demonstrate some applied value in the research in that the comprehension behavior generalized to the home-room setting and to the two home-room teachers.

Analysis was also done on the effects of gradual fading of reinforcement (i.e., follow-up phase, Book C for Student 1 and Book A for Student 2). Previous data suggest that in order to facilitate generalization and maintenance reinforcement must be gradually faded out (e.g., O'Leary & Becker, 1967). The follow-up results showed no difference between the percent of correct answers for the books for which fading was carried out (i.e., Book C for Student 1 and Book A for Student 2) and the other books. There are perhaps four possible explanations for this lack of difference. (1) Fading the reinforcement was unnecessary in this situation to achieve maintenance. (2) Fading of reinforcement with one book may have been necessary to bring about maintenance of reading comprehension in the absence of reinforcement with the other books. (3) Since the follow-up phases were the fourth reading of each book the students remembered the majority of the questions and attended to those sections of the books when reading. (4) Reading comprehension behavior had come under the control of some natural reinforcers as in the "behavioral trap" situation (Baer & Wolf, 1970), which may or may not have been enhanced by the fading of reinforcement with the first book.

The data on the number of reading errors conflicts somewhat with that of the comprehension data. While the effects of training upon reducing the number of reading errors are very clear and dramatic, the follow-up data shows a trend towards returning to original baseline levels. If one was to analyze these data by themselves it would appear that maintenance was not very strong. One possible explanation again, is that by the follow-up phase

the students could remember a majority of the questions and were therefore only attending to those sections which contained the answers and reducing their concentration on other sections. If this were the case then an increase in the number of reading errors would be expected.

There are a number of factors which argue against the idea that the data represents a practice effect due to subsequent readings of the books. First of all, the reading comprehension data from Baseline 1 to Baseline 2 do not show any significant or consistent increases, and the reading errors data show very clear stability during these two baselines. Yet in all six instances (3 books across 2 students) the percent correct for the reading comprehension data showed sharp increases while the number of reading errors dropped dramatically when tokens were introduced. This sudden change in behavior does not seem to be explained simply by a third reading of the book. Another point is that during baseline sessions, it took an average of 6.5 sessions to read each book (range 5 to 10 sessions) but during training and follow-up each book was completed in 5 sessions. Therefore, in these last two phases the students were reading more material, thus increasing the number of opportunities to make an error, and were being asked more questions, also increasing the opportunities to make a mistake. In spite of these increases in opportunity to make an error both the comprehension and the reading data showed dramatic improvements. There also were some anecdotal data on the students' behavior. During baselines they both read the books and answered questions in a "lazy manner" with feet up on the desk, the book held far away from them. When they were asked the comprehension questions they often shrugged their shoulders and did not attempt to answer. But, when reinforcement was introduced, they sat up straight, the book was held

very close, and they often used a pencil or their finger to underline each word as they read. When asked questions they could not answer, they often would get very upset and try very hard to remember the answer. Incidentally, this type of "lazy behavior" reappeared to some extent in the follow-up phases, especially for each student's last two books.

The data from this study also seem to provide some information about parameters or boundaries of generalization. The generalization probes conducted during the comprehension sessions showed that the behavior had generalized across settings and across trainers. Thus the concern over whether the direct application of token reinforcement negates generalization did not appear. However, token reinforcement for reading comprehension had little or no effect on the measures of writing behavior. Even though the comprehension answers and the written passages had similar topographies in that they both required writing, the presence and absence of generalization in the two cases was very clear cut. Therefore, researchers should note that behaviors under direct contingencies of token reinforcement will likely generalize, but those under indirect contingencies will probably not generalize. Therefore, if one is interested in specific behaviors generalizing, there must be at least some initial contact of that behavior with the token reinforcement contingencies.

In conclusion, this study showed that token reinforcement had a dramatic effect upon increasing reading comprehension behavior and in reducing reading errors. Generalization probes conducted showed that comprehension behavior generalized to different settings and trainers with no direct programming. Also, while the quality of descriptive and factual information, quantity of writing, and teacher's rankings of descriptive and factual information were unsuccessful in reflecting any effects of the reinforcement contingency upon

passage-writing behavior, they did provide some information on possible parameters of generalization in a token reinforcement program.

Finally, one last comment. When the two students returned to school this fall, they were both moved up two grades so that they are now at their proper grade level.

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Comprehension Questions - Book APage 5

1. Why are snakes called vertebrate animals?
2. Are snakes cold or warm blooded?
3. Why do snakes lie about in the sun?
4. What do snakes do in cold weather?

Page 6

1. Do snakes have eyelids?
2. What is the snake's tongue used for?
3. What is the snake's tongue not used for?
4. Do snakes hear very well? Why?
5. How can snakes swallow food whole?
6. How does a snake let go of its poison?

Page 8

1. How fast can a grass snake swallow a toad?
2. How can it breathe while swallowing the toad?

Page 9

1. What does sloughing mean?
2. Is the snake's skin wet and slimy? What is it like?

Page 10

1. How do snakes have babies?
2. About how many weeks does it take the eggs to hatch?
3. Does the mother stay around the babies after they are hatched?

Page 11

1. What is the egg - tooth?

2. How soon after being born do baby snakes have to take care of themselves?
3. Is it true that some snakes are born alive?

Page 12

1. About how many feet can the Malay Python grow up to?
2. Name two countries where the Malay Python is found.
3. Why is the Malay Python called a constrictor?

Page 13

1. What continent does the Boa Constrictor live in?
2. Name the two colors of the Boa Constrictor.
3. What is the difference between pythons and boas?

Page 14

1. What is another name for the Anaconda?
2. How quickly can the Anaconda kill its prey?
3. How does the Anaconda and other constrictors kill their prey?

Page 15

1. Which snake is a great favorite of circus people because it becomes very tame?
2. Is it true that these large Indian pythons can kill and swallow humans?
3. Name two of the normal prey of the Indian python.

Page 16

1. In what country is the Adder snake found?
2. Does the Adder snake usually attack people?

Page 17

1. In what country does the Gaboon viper live?

2. What type of body does the Gaboon viper have?
3. Are vipers fast and graceful?

Page 18

1. How did the Diamondback Rattlesnake get its name?
2. What area in North America does the Diamondback live?
3. What does the Diamondback do in winter time?

Page 19

1. Name three places where the Indian cobra is found.
2. Why is the Indian cobra sometimes called the hooded cobra?
3. Why do some people in India worship the Indian cobra?
4. Is the Indian cobra dancing to the snake charmer's music?

Page 20

1. Name two of the world's most dangerous snakes found in Africa.
2. The Black and Green Mambas may grow up to how many feet?

Page 21

1. Name two places where kraits are found.
2. Are kraits very fast?
3. How do people usually get bitten by a krait?

Page 22

1. In what continent do you find the Coral snake?
2. What do the bright colors on animals such as blacks, reds and/or yellows mean?

Page 23

1. Are Grass snakes good swimmers?
2. What color is the Grass snake?
3. Name two animals the Grass snake hunts.
4. How does a pet Grass snake recognize its master?

5. What does a Grass snake do when frightened?

Page 24

1. What is the name of the most beautiful snake found in Europe?
2. What country does the Leopard snake live in?
3. How did the Leopard snake get its name?

Page 25

1. Where is the King snake found?
2. How does the King snake kill its prey?
3. Why are King snakes useful?
4. What other animal does the King snake eat besides mice?

Page 26

1. Why is the Milk snake useful to the farmer?

Page 27

1. What is the name of North America's most common snake?
2. How are baby Garter snakes born?
3. How many young can a Garter snake give birth to?
4. Name two animals the Garter snake feeds on?

Page 28

1. How did the Egg-eating snake of Africa get its name?
2. How does the Egg-eating snake crack the egg shell?
3. What does it do with the broken shell?

Page 29

1. Can snakes really fly?
2. How does a Flying snake escape from its enemies?
3. Where is the Flying snake found?

Page 30

1. What is the Aesculapian snake well known for?

2. What symbol of an Aesculapian snake do we still see today?

Page 31

1. What does the Hog-nosed snake do when attacked or picked up?
2. What continent is the Hog-nosed snake found in?

Page 32

1. Name two places where the Sea snake is found.
2. What does the tail of the Sea snake look like?
3. Where are baby Sea snakes born?
4. Is the Sea snake's poison deadly?

Comprehension Questions - Book BPage 5

1. Do any human beings or four-footed creatures live on the Antarctic?
2. What time during the year do the whales feed in the Antarctic seas?

Page 6

1. What is the difference between the two kinds of whales?
2. What does krill mean?
3. Are whales fish?
4. How do whales keep warm in the cold water?
5. What is the largest animal in the world?
6. What other kind of whale besides the Whalebone are common in the Antarctic seas?
7. Name two products made out of the oil from whales?

Page 8

1. What is the largest whale with teeth?
2. What was the waxy oil found in the whale's head once used for?
3. What is ambergris?
4. How many feet may a large bull Sperm whale grow up to?

Page 10

1. What is the name of one of the fiercest and most ruthless hunters of the sea?
2. When attacking whales or seals what does the Killer whale do?
3. What part of the Killer whale's body makes it easy to recognize?
4. Where are the Killer whales most abundant?

Page 12

1. What is the only other mammal in the Antarctic besides the whale?

2. What are the two kinds of seals found in the Antarctic?
3. Which seal has ears that are visible?
4. Which seal is almost helpless when out of the water?
5. How many different types of true seals are there?
6. What does the Leopard seal feed mainly on?
7. Does the Crabeater or White seal feed on crabs?
8. How many feet long is the White seal?
9. Can the Weddell seal move around well on the ground?
10. What does the Weddell seal do when disturbed or frightened?
11. What is the name of the seal which has pouches in its neck around the windpipe which help to produce a loud trumpeting cry?

Page 14

1. What is the name of the largest true seal found in the Antarctic?
2. Why is this seal slaughtered like whales in large numbers?
3. How many feet does the Elephant seal grow to?
4. How did the Elephant seal get its name?
5. What color is the Elephant seal's pup?

Page 16

1. Why does the Fur seal only need a thin layer of blubber under the skin for warmth?

Page 18

1. What type of animals are penguins?
2. What do penguins use their wings for?
3. How many weeks does it take penguin chicks to hatch?
4. How do the chicks feed?

Page 21

1. What is the name of the most common and most numerous penguin in

the Antarctic?

2. How can you recognize a Ringed or Chinstrap penguin?

Page 22

1. What is the name of the largest penguin?
2. Is the male or female Emperor penguin the one who hatches the egg?
3. What happens the instant a chick is hatched?

Page 24

1. Why are the Gentoo chicks of different sizes?
2. What type of penguin has excellent eggs with deep red yolks?
3. What is the name of the handsomest penguin?
4. Does the King penguin make a nest?
5. What is the name of the penguin which is fierce and very quarrelsome?
6. What is the name of the penguin who is the small cousin of the Macaroni penguin?

Page 26

1. Where are the petrels nostrils found?
2. Is the Wilson's storm petrel big or small?
3. What is the name of the most beautiful and famous petrel?
4. The wandering albatross has a wing span of how many feet?

Page 27

1. How many months does the wandering albatross sit on land while its parents feed it?
2. Do the Wandering albatross breed every year?

Page 28

1. What is the name of the largest petrel?
2. What is this giant petrel's nickname?



3. Why do they call this petrel the stinker?
4. Why does this giant petrel also have the nickname Nelly?

Page 29

1. What is the name of one of the most familiar birds in the Antarctic?

Page 30

1. What does it mean when you see a Snow petrel or an Antarctic petrel out in the sea?
2. Why does the Whale bird or Prion never approach land during daylight?

Page 31

1. What is the name of the fiercest bird of prey in the Antarctic?
2. What is different about the appearance of the Cormorant?

Page 32

1. What is so special about the Sheathbill or Paddy?

Comprehension Questions - Book CPage 5

1. What fraction of the world's land surface is covered by desert or semi-desert?
2. The Sahara Desert covers how many million square miles?

Page 6

1. Are the nights warm in the desert?
2. What does wadis mean?
3. Are all deserts sandy?
4. Why do desert shrubs have sharp prickly thorns?

Page 8

1. What do camels have in their hump?
2. Does the body temperature of the camel remain the same throughout the day?
3. How does the camel keep warm at night?

Page 9

1. A Dromedary has how many humps?
2. Why do camels have fleshy pads on their feet?
3. There are how many words in the Arabic language to describe the camel?

Page 10

1. What is the second largest animal in the desert?
2. What color is the onager from Central Asia?
3. What country are kangaroos found in?
4. How do kangaroos move about?
5. What does marsupium mean?

Page 13

1. How do antelopes keep cool in the daytime?

2. How do antelopes get most of their water?
3. What color is the Beisa of East Africa and Ethiopia?
4. How does an Oryx protect itself from its enemies?

Page 14

1. Why does the Fennec fox eat more different types of food than other foxes?
2. How does the Grasshopper mice get its water?

Page 16

1. What are the long ears of the hare used for besides listening?
2. What does aestivate mean?
3. What kind of animal is the poor-will?
4. Where does the poor-will live?
5. What type of snake does the ground squirrel live with?

Page 18

1. How do Jerboas and Kangaroo rats move about?
2. Is it true that the Mongolian gerbil does not live well in captivity and is a terrible pet?
3. Why don't Jerboas and Gerbils sweat?
4. How does the Kangaroo rat cool its body?

Page 20

1. Why do birds pant?
2. How does a father Sand Grouse bring water back to his babies in the nest?
3. How do large flying birds like the eagle and vulture keep cool?

Page 21

1. How can Ostriches drink salt water?
2. Can the Ostrich lose much of its body water without ill effect?

Page 22

1. What type of animal are lizards and tortoises?
2. How do lizards get their water?
3. Why do lizards have a fringe of scales on their toes?

Page 23

1. What does a banded gecko look like?
2. How do tortoises cool off when they get too hot?

Page 24

1. Are snakes as common as lizards?
2. How do snakes get their water?
3. Up to how many inches can a snake detect the warmth of their prey?
4. How does a snake like the African horned viper get away from the heat?

Page 25

1. What is the rattlesnake's rattle made of?
2. Do snakes deliberately bite people?
3. What is the snake's poison really intended for?

Page 27

1. How many pairs of legs do arachnids have?
2. Name one animal which is an arachnid?
3. Do most of the scorpions have poison which is dangerous to man?
4. What do baby scorpions do when they are young?
5. Is it true that the Camel-spider is generous with his food and will share it?

Page 28

1. What does the Scarab beetle do with camel dung?
2. Is it true that the Darkling beetle can live for years without food and water?

3. Is the Darkling beetle good to eat?
4. Insects have how many legs?
5. How many pairs of legs does a Woodlice have?