EVALUATING THE USE OF THE TACHISTOSCOPE AS AN AID IN TEACHING READING IN GRADES FOUR THROUGH EIGHT

A Thesis

Presented to

the Faculty of the School of Education

Appalachian State Teachers College

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts in Education

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by

Helen Finch McNeely

May 1958

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The purpose of this study was to evaluate the use of the tachistoscope as an aid in teaching reading in the upper five elementary grades. In making this appraisal, an attempt was made to determine reading progress made by each of the ten participating classes and to compare the progress of those students instructed with the tachistoscope with those students who were taught reading without the aid of this device.

Participating in the investigation were 127 students in the control classes and 148 students in the experimental classes. When a comparison of the intelligence quotients at each of the five experimental classes was made with the same measures at each of the equivalent control grade levels, no significant difference in intelligence was observed.

Pupils in the experimental classes were given fourteen weeks of instruction with the aid of the tachistoscope in addition to regular instruction in reading; students in the control classes received reading instruction by regular classroom procedures. Evaluations were made by pre-testing and post-testing with two forms of Iowa Silent Reading Test.

In analyzing improvement made by the ten classes, the fourth, sixth, and eighth grade classes from the experimental group and the fourth and eighth grade classes from the control group progressed significantly in reading

comprehension; the fourth, fifth, and eighth from the control group and the eighth from the experimental group improved enough on directed reading to be significant; the fourth grade control class and the eighth grade experimental class showed significant improvement in rate; the fifth grades in both groups made significant progress in word meaning; the control fourth grade improved significantly in paragraph comprehension; the fourth and fifth grades in the experimental group made significant progress in alphabetizing; the fourth grade from the experimental group and fifth grade from the control group made significant improvement in the use of the index.

When the experimental and control students were compared on the amount of improvement on the eight reading measures at each of the five grade levels, in only five out of forty comparisons was there enough difference to be classified as significant. Three of the differences were in favor of the experimental classes, while two were in favor of the control groups.

It was concluded that there was not enough evidence that the tachistoscope was an attributing factor in causing reading progress in the study, however, it was thought that conducting an experiment of this nature is one excellent technique of focusing attention on reading and, thereby, improving the quality of reading instruction.

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CHAPTER I

INTRODUCTION

The purpose of this study was to evaluate the use of the tachistoscope as an aid in teaching reading in the upper five elementary grades. In making this appraisal, the writer undertook two specific problems. First, an attempt was made to determine reading progress of each grade which participated in the study. Second, a comparison was made of the reading progress of those pupils who were given additional instruction with the tachistoscope with those pupils who were taught reading without the aid of this device.

I. DESCRIPTION OF PARTICIPATING STUDENTS

In conducting the study, the writer decided to limit pupil participation to pupils in the fourth, fifth, sixth, seventh, and eighth grades. Since one of the problems was to compare the reading progress of pupils instructed by the aid of the tachistoscope with the reading progress of pupils who followed conventional reading instruction, it was necessary to establish at least two groups at each grade level.

In grades four through eight at the Hildebran School, there were four classes at the fourth-grade level, four classes at the fifth-grade level, four classes at the sixth-

grade level, three classes at the seventh-grade level, and three classes at the eighth-grade level. Each of these classes was administered the California Test of Mental Maturity, 1950 Short Form, following which the total intelligence quotient means for each class were determined.

After the writer inspected the means at the five class levels, she selected for investigation two classes at each level which most closely approximated each other in mean intelligence. A draw was made to determine which one of the two classes at each level was to be instructed by the two methods respectively. The five classes instructed with the aid of the tachistoscope were called the experimental groups; the other five groups were designated as the control groups.

A comparison of the intelligence quotient means for the five experimental classes and the total experimental group were compared with the intelligence quotient means of five classes from the control classes and the total control group. Table I shows the number of students at each grade level for the control and experimental groups; and the intelligence quotient means, the difference in means, and the probability of difference of means for each grade level for the two compared groups.

Table I shows there was a total of 127 pupils in the control group and 148 pupils in the experimental group.

TABLE I

NUMBER OF STUDENTS, AVERAGE INTELLIGENCE QUOTIENTS, AND DIFFERENCES IN INTELLIGENCE QUOTIENTS BY GRADES FOR CONTROL AND EXPERIMENTAL GROUPS

Grade	Control Group		Experimental Group		Difference in Mean I.Q.	Critical Ratio
	Number	Mean I.Q.	Number	Mean I.Q.		
Fourth	28	102.10	30	100.85	1.25	1.45*
Fifth	25	99.15	28	101.10	-1.95	1.62
Sixth	26	97.11	30	99.94	-2.83	1.94
Seventh	28	96.17	30	96.74	- .57	.78
Eighth	22	99.40	30	100.60	1.20	1.01
Total	129	98.58	148	99.60	1.02	.92

*Critical ratios in all cases are less than required for significance at .01 level.

At each grade level there were more students to be instructed in the experimental groups than in the control groups. At the fourth and eighth grade levels there was a mean intelligence quotient difference of 1.25 and 1.20, respectively, in favor of the control group. On the other hand, at the fifth-, sixth-, and seventh-grade levels there was, in favor of the experimental, a mean difference of 1.95, 2.83, and 0.57, respectively. For the total group the mean of 99.60 for the experimental pupils was found to be 1.02 greater than the mean of 98.58 for the control pupils.

Upon comparing the experimental and control groups, the writer discovered that there was no significant difference in intelligence quotients between the classes which were instructed and those which were not instructed by employing the aid of the tachistoscope. When statistically compared, all of the observed difference resulted in a critical ratio which was less than that required for significance at .05 level of confidence. It was assumed, therefore, that the two groups being investigated at all levels had comparable intelligence.

II. PROCEDURE FOR CONDUCTING STUDY

An orientation period was held for the teachers participating in the study, at which time they were instructed in the use of the tachistoscope and the purpose and mechanics

of the proposed study. Following the teachers' orientation, information relative to the use of the tachistoscope was given only to those pupils who would be in the experimental groups.

The Testing. Prior to starting actual instruction with the aid of the tachistoscope, pupils in both the control and experimental groups were administered the Iowa Silent Reading Test, Form CM. After the period of experimental instruction, both groups were then given another form of the reading test, Iowa Silent Reading Test, Form DM. By following this procedure, the teachers could record a relatively accurate measure of the pupils' progress in eight areas of reading ability. Thus, the pre-study and post-study testing each yielded measures in reading rate, comprehension, directed reading, word meaning, paragraph comprehension, sentence meaning, alphabatizing, and the use of index.

Instructional Procedure. Teachers who had classes which were selected in the control group were instructed to follow their regular schedule and procedure in teaching reading. Pupils in the experimental group were also to receive the regular instruction already adopted by their teachers; but, in addition, they were to receive approximately twenty minutes of drill with the tachistoscope per day over a period of fourteen weeks.

In conducting the drills for the experimental classes, the teachers followed directions which came with the Keystone Slides and the Keystone Flashmeter. The first few sessions were designed to get the pupils accustomed to looking for the tachistoscope flash as they looked for primary and geometric forms such as garden tools, toys, and triangles and squares. Then a short period of time was devoted to visual spacing slides which presented numbers two, three, four, up to seven or eight digits. The object of these slides was to train the pupils' eyes to see many numbers at one fixation and to increase their span of sight.

After six or seven sessions with primary figures and numbers, shorter words, longer words, phrases, and finally, sentences were progressively shown at increasing flash speeds.

The plan was made to determine whether the above procedure with the aid of the tachistoscope and the progressive use of the prepared slides would bring about improved reading through better attention, shorter eye fixation, increased span of apprehension, and proper left to right fixations.

III. STATISTICAL PROCEDURE USED IN EVALUATION

In appraising the tachistoscope as an aid in teaching reading in the upper elementary grades, the teachers attempted to obtain answers to two questions:

(1) Was any progress in reading made by the control and experimental groups during the period of time the experiment was in progress?

(2) Was there any significant difference in the amount of reading progress made between those pupils receiving and those not receiving the tachistoscope drills?

The same statistical procedures were employed in answering both questions. To answer the first question above, a null hypothesis was projected which stated that there was no improvement in reading ability for the classes in the control and the experimental groups over the period of time the investigation was in progress. Similarly, a null hypothesis was formulated which stated that there was no true difference in the amount of reading progress made by the control and experimental groups during the investigation.

In order to determine whether the formulated hypothesis would be rejected the "t" test was made. The first step undertaken in the test was designed to determine the means and the difference of means for the two measures or groups under consideration. The determination of the probability that a difference between the means is significant was found by calculating the ratio of the observed means to the standard error of their difference. The formula used follows:

$$t = \frac{m_1 - m^2}{6m_1 - m^2}$$

In order to find the value of "t" required for various levels of significance, one can refer to tables in any recent standard test book on statistics.

Since the calculations made in this study were made from ungrouped data, the formula used in determining the means and standard error of the difference of means follows:[1]

$$\text{Mean } (M) = \frac{X}{N}$$

Standard error of difference of means $(6m_1 - m_2) =$

$$\sqrt{\frac{x_1^2 + x_2^2}{N_1 + N_2 - 2} \cdot \frac{N_1 + N_2}{N_1 N_2}}$$

The formula for finding x^2 was:

$$x^2 = X^2 - \frac{(X)^2}{n}$$

Whether a hypothesis is rejected depends on what level of certainty is required. In certain fields of research it has become conventional to use the "five per cent level of significance" -- that is, to reject the null hypothesis when the probability of difference is equal to or less than

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[1] Margaret Jarman Hagood, Statistics For Sociologists (New York; Henry Holt and Company, 1941), P. 445.

the .05 level -- in others, to use the "one per cent level of significance" -- that is, to reject the null hypothesis when p .01 -- and in still other fields, to use the "one tenth of one per cent level of significance" -- that is, to reject only when p .001.

No arbitrary level has been adopted in most fields of educational research, and the choice of level is the decision of the individual doing the research. Since in many experiments, one is trying to establish significance, the selection of the one per cent level or the one tenth of one per cent level is more "conservative" than the choice of the five per cent level. In this investigation there was no attempt to prove or disprove that the tachistoscope is an effective aid in improving reading skills; therefore, the level (.01) between the two extremes was selected.

IV. RELATED STUDIES

A search through indexes and literature produces several articles related to the use of the tachistoscope. A selected number of these studies which are similar in nature to this investigation follow.

Groffame[2] conducted a study in 1956 with eleven Pennsylvania Government officials. These men were given seven ninty minute training sessions which were almost

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[2]D. T. Groffan, "Report on An Adult Reading Program," (Unpublished report, Dickenson College, Carlisle, Pennsylvania) Pps. 1-2.

entirely devoted to tachistoscope training. Progress was determined by administering forms H and G of the Survey Section of the Diagnostic Reading Test Battery. Results show that the average gain in total reading ability as expressed in percentages was eighteen, but the rate of reading semi-technical materials improved 33 per cent. When the group median for the initial test was compared with college freshmen, it placed at the thirty-first percentile; whereas, at the end of the experiment, the median had increased to the fifty-eighth percentile.

In 1957 Payne[3] reported on the effect of the use of the tachistoscope and the reading accelerator upon the reading achievement of eighth grade pupils in Indianapolis Elementary Schools. The experimental part of the investigation consisted of three groups from eighth-grade classes in the city; a control group was also selected at the same level. One group was given, in addition to regular reading instruction, forty-five minutes each week with the tachistoscope. The second group was given forty-five minutes each week with the reading accelerator. Group three was given forty-five minutes of work each week with the tachistoscope plus forty-five minutes of work each week with the accelerator.

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[3] Joseph C. Payne, "The Effect of the Use of the Tachistoscope and the Reading Accelerator Upon the Reading Achievement of Eighth Grade Pupils in Indianapolis Elementary Schools," The Researcher, 2:2-6, October, 1957.

The four groups, including the control group, were tested before and after the experimental period with the Gates Reading Survey. The first test was administered in November, and the final test, in May. The test measures vocabulary, comprehension, and rate of reading. In making a statistical analysis of the difference of means, less .6 grade equivalent alloted for expected normal growth, was employed. The 5 per cent level of confidence was assumed to determine the reliability of progress.

Results showed that, generally, the total experimental group gained 1.3 grade equivalent. Compared with the control group gain of .8 grade equivalent, it can be inferred that mechanical reading devices did have some effect upon the reading ability of eighth grade pupils concerned with the experiment.

More specifically, it was shown that the use of the tachistoscope has an effect upon the vocabulary, reading rate, and average reading grade equivalents of the pupils; but that the accelerator had no discernable effect upon the vocabulary, comprehension, or reading speed of the pupils. However, examination of the third group which used the tachistoscope and the accelerator indicates that there was an effect upon the reading of the pupil and upon the average reading grade equivalent.

It was pointed out in this study that neither of the reading devices affected the reading comprehension of pupils.

Siverson[4] used the tachistoscope to see whether he could get reading improvement in an unsectioned English class. The machine was employed fifteen minutes per day for five weeks. An evaluation was made by pre-testing and post-testing with two forms of the Iowa Silent Reading Test. Results demonstrated that all ability levels were able to profit from the experiment. When the students were divided into lower, middle, and upper quartiles on the basis of initial test scores, the top quartile showed a median percentile gain of 15.2; the lower, a median percentile gain of 17.3; and the middle fifty per cent, a median percentile gain of 23.7. The author also pointed out that the students, especially those in the lower quartile, demonstrated a positive change in attitude toward reading.

Goins[5] experimented with the tachistoscope to determine whether weakness in visual perception can be strengthened by giving instruction with the machine. Her conclusion was that training was more effective with persons who were good perceivers, but it had little effect on those who scored low on

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[4]Lyle E. Siverson, "We Obtained Reading Improvement With the Tachistoscope," Teaching Tools, Number 8:173-174, 1953.

[5]H. M. Robinson, "Tachistoscope in Reading," Elementary School Journal, 55:49, May, 1954.

perception tests.

In a report by Smith and Tate[6] a discussion was given of an attempt to gain information concerning the amount of improvement in an adult reading class which might accompany the use of the tachistoscope. The two experimented with eighteen college students who had volunteered to take extensive preliminary and post-tests and to participate in a minimum of thirty-five training periods of fifty minutes each. One half of each training period was spent flashing digits onto a small screen with the tachistoscope. The other half of the period was devoted to reading material on the controller.

Substantial improvement was shown in comprehension and rate; however, the improvement in rate as measured by reading tests was not as great as was shown on the controller.

Another study of the effect of tachistoscopic training in an adult reading program was conducted by Manolaskes.[7] Both a control and experimental group were given pre-tests and post-tests in order to evaluate progress. Both groups followed a normal course of instruction; but, in addition,

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[6] H. P. Smith and T. R. Tate, "Improvement of Reading Rate and Comprehension of Subject Training With the Tachistoscope," Journal of Educational Psychology, 44:176-184, March, 1953.

[7] George Manolaskes, "Effects of Tachistoscopic Training in An Adult Reading Program," Journal of Applied Psychology, 36:410-412, December, 1952.

the experimental group was given eighteen twelve and one half minutes training sessions with the tachistoscope. The experiment indicated that the control group was not penalized through a lack of tachistoscopic training.

An adult reading class[8] was given normal reading instructions on vocabulary for fourteen sessions of fifteen minutes each with the aid of the tachistoscope. In terms of the Nelson Denny test results, the class made significant improvement in rate, comprehension, and vocabulary. The experimenter states that it is impossible to say exactly how much each separate class actively contributed to the results, since the only training done with the tachistoscope was with vocabulary building.

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[8]James I. Brown, "Vocabulary via Tachistoscope; A Visual Approach to Improved Reading Ability," Education Screen, 30:274+, September, 1951.

CHAPTER II

FINDINGS OF THE STUDY

The purpose of this chapter is to present the findings of the investigation concerning two basic problems in the study: One was to determine progress in reading if any were made by the ten classes comprising the control and experimental groups during the fourteen week experiment. The other problem was to discover at the end of the study significant difference, if there were any, in the amount of progress between the control and experimental groups in the eight reading areas.

I. IMPROVEMENT IN READING ABILITY

In order to solve the first problem, the probability of the significance of difference between the mean grade level of achievement for the pre-study test and post-study test for each of the five control and five experimental classes was determined for each of the eight reading areas measured.

Table II presents the results for each of the ten classes on reading rate. For example, it is seen that the grade level score of 3.8 on reading rate for the experimental class of fourth graders on the test taken after being instructed with the aid of the tachistoscope was 1.4 greater than the mean grade level of 2.4 obtained on the group before the

TABLE II

SIGNIFICANCE OF DIFFERENCE OF MEANS BETWEEN PRE-STUDY TESTING AND POST-STUDY TESTING FOR EACH CLASS ON IMPROVEMENT ON READING RATE

Class	No.	Mean Grade Level Second Test	Mean Grade Level First Test	Difference In Mean	Critical Ratio
4t*	30	3.8	2.4	1.4	2.34*
4y	28	4.6	2.6	2.0	2.81**
5t	28	5.5	3.5	2.0	2.59*
5y	25	4.2	3.8	.4	.64
6t	30	7.0	4.8	2.2	2.30*
6y	26	5.1	6.2	-1.1	1.00
7t	30	5.3	5.5	- .2	.35
7y	28	7.0	6.8	.2	.13
8t	30	8.1	5.6	2.5	5.75**
8y	22	7.4	6.4	1.0	.99

* t = machine
y = no machine

** Significant at .01 level
* Significant at .05 level

experiment started. A statistical analysis showed that the observed difference was not great enough to obtain the critical required for significance at the .01 level. Therefore, based on the level of significance selected for this study, it was concluded that there was no true difference in improvement in reading rate for the fourth-grade group which was instructed with the tachistoscope.

On the other hand, it was found that the fourth-grade class which did not receive instruction with the aid of a tachistoscope demonstrated a significant improvement in reading rate during the same period of time. The critical ratio of 2.81 obtained from the difference of 2.0 between the second test mean grade level of 4.6 and the first test mean level of 2.6 was significant at the .01 level.

It is seen that the other four classes (fifth, sixth, seventh, and eighth) in the control group made no measurable progress in reading rate. For the other four classes from the experimental groups, only the eighth grade made significant improvement in reading rate. In this case, the difference of 2.5 between the post-test grade level mean of 8.1 and the pre-test grade level mean of 5.6 resulted in a critical ratio of 5.75 which was much greater than that needed for significance at the .01 level. The differences between the two tests for the fifth- and sixth-grade classes from the experimental group were only large enough to be

significant at the .05 level. The experimental group of the seventh grade made a negative change of two months after being instructed with the aid of a tachistoscope.

It was observed that all ten classes made improvement in reading comprehension during the fourteen-week investigation (Table III), although the progress was great enough in only five classes to be classified as significant. This was true for three classes (fourth, sixth, and eighth) from the experimental groups, and for only two classes (fourth and eighth) from the control groups.

Significant improvement in directed reading was observed for the control groups in grades four, five, and eight, and for the experimental group in only the eighth grade (Table IV). Although the other classes did not improve enough to be classified as having made a significant gain, in each class the second test mean score was larger than the mean obtained in the pre-testing.

Except for the two fifth grades (both experimental and control), there was no "true" improvement in word meaning during the experiment (Table V).

It is observed in Table VI that only the fourth grade, which was not instructed with the aid of the tachistoscope, made significant improvement during the investigation in paragraph meaning. This class made improvement in the second test of 2.4 over the first test. All the other classes made

TABLE III

SIGNIFICANCE OF DIFFERENCE OF MEANS BETWEEN PRE-STUDY TESTING AND POST-STUDY TESTING FOR EACH CLASS ON IMPROVEMENT ON READING COMPREHENSION

Class	No.	Mean Grade Level Second Test	Mean Grade Level First Test	Difference In Mean	Critical Ratio
4t*	30	5.1	3.1	2.0	3.61**
4y	28	5.6	3.0	2.6	5.22**
5t	28	5.4	4.7	.7	1.03
5y	25	4.5	3.2	1.3	2.01
6t	30	7.0	4.8	2.2	3.73**
6y	26	6.8	5.3	1.5	2.07*
7t	30	7.5	5.6	1.9	2.43*
7y	28	6.6	6.0	.6	1.04
8t	30	9.2	7.4	1.8	2.66**
8y	22	9.3	7.2	2.1	3.34**

* t = machine
y = no machine

** Significant at .01 level
* Significant at .05 level

TABLE IV

SIGNIFICANCE OF DIFFERENCE OF MEANS BETWEEN PRE-STUDY TESTING AND POST-STUDY TESTING FOR EACH CLASS ON IMPROVEMENT ON DIRECTED READING

Class	No.	Mean Grade Level Second Test	Mean Grade Level First Test	Difference In Mean	Critical Ratio
4t*	30	4.7	4.1	.6	1.39
4y	28	5.4	4.3	1.1	3.52**
5t	28	5.8	5.2	.6	1.56
5y	25	5.5	3.6	1.9	5.08**
6t	30	6.4	5.8	.6	1.65
6y	26	6.4	5.5	.9	2.19*
7t	30	7.2	6.0	1.2	2.03
7y	28	7.6	7.1	.5	.62
8t	30	10.3	6.8	3.5	4.16**
8y	22	10.3	8.4	1.9	5.08**

* t = machine
y = no machine

** Significant at .01 level
* Significant at .05 level

TABLE V

SIGNIFICANCE OF DIFFERENCE OF MEAN BETWEEN PRE-STUDY TESTING AND POST-STUDY TESTING FOR EACH CLASS ON IMPROVEMENT ON WORD MEANING

Class*	No.	Mean Grade Level Second Test	Mean Grade Level First Test	Difference In Mean	Critical Ratio
4t	30	4.2	4.2	.0	.05
4y	28	4.7	4.0	.7	1.56
5t	28	5.8	4.8	1.0	2.68**
5y	25	5.2	4.1	1.1	2.89**
6t	30	6.2	5.4	.8	1.72
6y	26	6.2	5.7	.5	1.23
7t	30	6.8	6.4	.4	.93
7y	28	6.7	5.9	.8	2.17*
8t	22	7.2	7.9	- .7	1.28
8y	30	8.3	7.6	.7	1.55

* t = machine
y = no machine

** Significant at .01 level
* Significant at .05 level

TABLE VI

SIGNIFICANCE OF DIFFERENCE OF MEAN BETWEEN PRE-STUDY TESTING AND POST-STUDY TESTING FOR EACH CLASS ON IMPROVEMENT ON PARAGRAPH COMPREHENSION

Class	No.	Mean Grade Level Second Test	Mean Grade Level First Test	Difference In Mean	Critical Ratio
4t	30	4.1	3.5	.6	1.25
4y	28	5.2	2.8	2.4	6.91**
5t	28	4.7	4.0	.7	1.49
5y	25	4.3	4.3	.0	0.00
6t	30	5.3	4.9	.4	.80
6y	26	5.3	4.9	.4	1.07
7t	30	5.8	4.9	.9	1.60
7y	28	5.7	5.5	.2	.45
8t	30	6.8	5.9	.2	.45
8y	22	7.0	7.0	.0	.07

* t = machine
y = no machine

** Significant at .01 level
* Significant at .05 level

less than a year's progress.

In observing Table VII, one sees that, as a result of the experiment, no significant degree of improvement on sentence meaning was observed in any of the ten classes. The most improvement was recorded for the experimental classes in the fifth and sixth grades, where the differences between the second and first tests were great enough to be significant at the .05 level.

Although there were five classes which improved more than one year in alphabetizing, statistical analysis found only two grades (fourth and fifth from the control groups) showing enough change to be significant at the .01 level. The seventh grade experimental class, with a 2.1 improvement, showed enough progress to be significant at the .05 level.

Table IX presents the significance of difference of means on the use of the index for pre-test and post-test for the ten classes participating in the experiment. One sees, as he saw in the other reading areas, that a majority of the classes did not improve significantly on this measure. Only the fourth-grade experimental class, which showed an improvement of 1.5, and the fifth-grade control class, which recorded a change of 1.0, proved to have enough difference in the use of index scores before and after the experiment in order to be classified as having improved significantly.

TABLE VII

SIGNIFICANCE OF DIFFERENCE OF MEAN BETWEEN PRE-STUDY TESTING AND POST-STUDY TESTING FOR EACH CLASS ON IMPROVEMENT ON SENTENCE MEANING

Class	No.	Mean Grade Level Second Test	Mean Grade Level First Test	Difference In Mean	Critical Ratio
4t*	30	3.8	3.0	.8	1.27
4y	28	3.8	3.5	.3	.74
5t	28	5.2	3.7	1.5	2.52**
5y	25	4.4	4.0	.4	.60
6t	30	7.0	5.3	1.7	2.59**
6y	26	6.3	5.7	.6	1.16
7t	30	6.3	6.8	- .5	.93
7y	28	5.9	5.6	.3	.45
8t	30	6.9	7.1	- .2	.33
8y	22	8.0	7.4	.6	.87

* t = machine
y = no machine

** Significant at .01 level
* Significant at .05 level

TABLE VIII

SIGNIFICANCE OF DIFFERENCE OF MEAN BETWEEN PRE-STUDY TESTING AND POST-STUDY TESTING FOR EACH CLASS ON IMPROVEMENT ON ALPHABETIZING

Class	No.	Mean Grade Level Second Test	Mean Grade Level First Test	Difference In Mean	Critical Ratio
4t*	30	5.7	3.6	2.1	4.07**
4y	28	4.8	4.5	.2	.01
5t	28	6.4	5.1	1.3	2.89**
5y	25	5.4	5.1	.3	.66
6t	30	7.2	6.3	.9	1.19
6y	26	6.9	6.7	.2	.16
7t	30	8.8	6.7	2.1	2.19*
7y	28	7.7	7.7	.0	.01
8t	30	10.1	8.3	1.8	1.62
8y	22	11.0	8.3	2.7	1.63

* t = machine
y = no machine

** Significant at .01 level
* Significant at .05 level

TABLE IX

SIGNIFICANCE OF DIFFERENCE OF MEAN BETWEEN PRE-STUDY TESTING AND POST-STUDY TESTING FOR EACH CLASS ON IMPROVEMENT ON INDEX

Class	No.	Mean Grade Level Second Test	Mean Grade Level First Test	Difference In Mean	Critical Ratio
4t*	30	4.8	3.1	1.5	2.90**
4y	28	4.0	3.9	.1	.82
5t	28	6.2	4.7	1.5	2.50*
5y	25	5.1	4.1	1.0	3.35**
6t	30	6.7	5.8	.9	1.51
6y	26	6.5	5.9	.6	.80
7t	30	7.4	6.5	.9	1.38
7y	28	7.4	6.6	.8	1.42
8t	30	8.4	8.2	.2	.33
8y	22	8.8	9.4	- .6	.71

* t = machine
y = no machine

** Significant at .01 level
* Significant at .05 level

II. COMPARISON OF READING PROGRESS

The second primary purpose of this study was done to determine whether there was any significant difference made in reading progress in the eight reading areas by the control and experimental groups during the time the study was in progress.

The first step in finding the answer to this problem was obtaining information on the change for each participating student in reading scores between the pre-study and the post-study test. After the change (difference) was determined for the eight reading scores for each student in the control and experimental groups, the significance of difference of mean improvement between those students who used and those who did not use the tachistoscope was determined. The statistical procedure for calculating the significance of difference in means in this case was identical to that employed in the first problem except for one minor point. Calculations this time were made from converted standard scores instead of grade equivalents. Since a number of the students showed a negative difference when the first test score was subtracted from the second test score, it was necessary to convert the difference so that all differences would be positive.

Table X presents the significance of difference of mean improvement between the total control and experimental

TABLE X

SIGNIFICANCE OF DIFFERENCE OF MEAN IMPROVEMENT BETWEEN THE CONTROL AND EXPERIMENTAL READING GROUPS FOR PRE-STUDY TESTING AND POST-STUDY TESTING FOR TOTAL GROUP

Test	Experimental Mean Improvement	Controlled Mean Improvement	Difference In Mean Improvement	Critical Ratio
Rate	74.43	67.93	6.50	2.17*
Comprehension	72.00	74.54	-2.54	1.96
Directed Reading	73.83	74.61	- .78	.48
Word Meaning	70.16	71.17	-1.01	.76
Paragraph Comprehension	71.16	72.31	-1.15	.54
Sentence Meaning	69.27	67.57	1.70	1.04
Alphabetizing	73.07	68.94	4.13	1.98*
Use of Index	73.30	69.12	4.18	2.49*

* Significant at .05 level

reading groups for each of the eight reading areas measured by the tests. It is observed that the total experimental group surpassed the total control group in improvement in rate (mean difference of 6.50), sentence meaning (mean difference of 1.70), alphabetizing (mean difference of 4.13), and use of the index (mean difference of 4.18). The total control group, on the other hand, demonstrated more progress than the total experimental group in comprehension (difference of 2.54), directed reading (difference of .78), word meaning (difference of 1.01), and paragraph comprehension (difference of 1.15).

None of the differences was large enough, however, to produce a critical ratio large enough to be significant at the .01 level. The mean differences in change in favor of the experimental group for rate, alphabetizing, and use of the index, were unusual enough to be significant at the .05 level.

The fourth-grade experimental class only surpassed the control fourth-grade class in improvement in word meaning, alphabetizing, and use of the index (Table XI). In these instances the observed differences were so small that one could conclude only that the variance, more than likely, should be attributed to chance occurance. On the other five measures, which showed a mean difference in favor of the control group, only the critical ratios for directed reading and paragraph comprehension were large enough to be significant

TABLE XI

SIGNIFICANCE OF DIFFERENCE OF MEAN IMPROVEMENT BETWEEN THE CONTROL AND EXPERIMENTAL READING GROUPS FOR PRE-STUDY TESTING AND POST-STUDY TESTING FOR GRADE FOUR

Test	Experimental Mean Change	Controlled Mean Change	Difference in Means	Critical Ratio
Rate	78.93	76.71	2.22	.50
Comprehension	74.90	85.21	-10.31	2.28*
Directed Reading	69.37	80.28	-10.91	3.18**
Word Meaning	68.30	73.54	- 5.24	1.71
Paragraph Comprehension	72.90	89.78	-16.88	3.51**
Sentence Meaning	70.37	70.39	- .02	.01
Alphabetizing	72.70	76.54	- 3.84	1.04
Use of Index	75.57	70.61	4.96	1.74

* Significant at .05 level
** Significant at .01 level

at the .01 level of confidence. The critical ratio for comprehension was large enough to be significant at the .05 level.

Table XII shows that the experimental group at the fifth-grade level made more improvement than the equivalent control group on all reading areas. The difference in mean improvement on sentence meaning was significant at the .01 level; whereas the variance on alphabetizing was significant at the .05 level.

On four reading areas (rate, directed reading, alphabetizing, and use of index) the sixth grade experimental class made more improvement than the control class; but the control class showed more improvement on the other four areas (Table XIII). Although the improvement on sentence meaning in favor of the control group was large enough to be significant at the .05 level, none of the differences at this grade level was great enough to meet the criterion for significance adapted to this study.

None of the mean differences in Table XIV for the seventh grade proved to be significant. However, the difference of 10.07 between the mean change of 75.03 for the experimental class and the mean change of 64.96 for the control group produced a critical ratio of 2.19 large enough for significance at the .05 level of confidence. In this table the control group surpassed the experimental group on rate,

TABLE XII

SIGNIFICANCE OF DIFFERENCE OF MEAN IMPROVEMENT BETWEEN THE CONTROL AND EXPERIMENTAL READING GROUPS FOR PRE-STUDY TESTING AND POST-STUDY TESTING FOR GRADE FIVE

Test	Experimental Mean Change	Controlled Mean Change	Difference in Means	Critical Ratio
Rate	76.78	67.16	9.62	1.97
Comprehension	69.14	72.64	-3.50	.66
Directed Reading	72.21	80.20	-7.99	1.48
Word Meaning	74.36	74.92	- .56	.23
Paragraph Comprehension	70.50	65.52	4.98	1.20
Sentence Meaning	76.50	66.28	15.20	3.96**
Alphabetizing	75.64	66.60	9.04	2.56*
Use of Index	75.75	72.60	3.15	.90

* Significant at .05 level
** Significant at .01 level

TABLE XIII

SIGNIFICANCE OF DIFFERENCE OF MEAN IMPROVEMENT BETWEEN THE CONTROL AND EXPERIMENTAL READING GROUPS FOR PRE-STUDY TESTING AND POST-STUDY TESTING FOR GRADE SIX

Test	Experimental Mean Change	Controlled Mean Change	Difference in Means	Critical Ratio
Rate	64.53	60.75	3.78	.74
Comprehension	73.90	74.46	- .56	.14
Directed Reading	74.03	73.92	.11	.04
Word Meaning	68.87	70.87	-2.00	.73
Paragraph Comprehension	73.13	72.25	.88	.18
Sentence Meaning	62.60	71.25	-8.65	2.40*
Alphabetizing	75.03	66.29	5.74	1.58

* Significant at .05 level

TABLE XIV

SIGNIFICANCE OF DIFFERENCE OF MEAN IMPROVEMENT BETWEEN THE CONTROL AND EXPERIMENTAL READING GROUPS FOR PRE-STUDY TESTING AND POST-STUDY TESTING FOR GRADE SEVEN

Test	Experimental Mean Change	Controlled Mean Change	Difference in Means	Critical Ratio
Rate	64.53	65.11	- .58	.14
Comprehension	73.90	69.96	3.94	1.06
Directed Reading	74.03	67.39	6.64	1.83
Word Meaning	68.89	68.28	.61	.27
Paragraph Comprehension	73.13	66.93	6.20	1.63
Sentence Meaning	62.60	64.68	-2.08	.51
Alphabetizing	75.03	64.96	10.07	2.19*
Use of Index	72.03	75.28	-3.25	.70

* Significant at .05 level

sentence meaning, and the use of the index.

Table XV shows that the difference in mean improvement on directed reading and use of index between the experimental group and the control group at grade eight was significant in favor of the experimental group at the .01 level. Except for one measure, comprehension, the experimental eighth graders made more improvement than the control pupils at the same level.

III. SUMMARY OF FINDINGS

Tables XVI and XVII summarize the results of this study. By a study of Table XVI, one can see that the fourth-grade control group and the eighth-grade experimental group made significant improvement (.01 level) on rate; the fourth-, sixth-, and eighth-grade experimental classes and the fourth- and eighth-grade control classes made definite improvement in comprehension; only the eighth-grade class from the experimental group and the fourth-, fifth-, and eighth-grade classes in the control group advanced significantly in directed reading; both the control and experimental fifth-grade classes made progress in word meaning; the fourth-grade control class improved significantly in paragraph meaning; none of the ten classes demonstrated a significant change in sentence meaning; the experimental classes at the fourth- and fifth-grade levels showed a true difference in alphabetizing; and the fourth-grade

TABLE XV

SIGNIFICANCE OF DIFFERENCE OF MEAN IMPROVEMENT BETWEEN THE CONTROL AND EXPERIMENTAL READING GROUPS FOR PRE-STUDY TESTING AND POST-STUDY TESTING FOR GRADE EIGHT

Test	Experimental Mean Change	Controlled Mean Change	Difference in Means	Critical Ratio
Rate	75.83	69.04	6.79	2.08
Comprehension	73.43	75.86	-2.43	.58
Directed Reading	81.03	70.95	10.08	2.78**
Word Meaning	68.26	67.86	.40	.12
Paragraph Comprehension	71.27	64.72	6.55	1.44
Sentence Meaning	66.80	65.09	1.71	.33
Alphabetizing	72.83	69.82	3.01	.60
Use of Index	73.63	58.54	15.09	3.27**

TABLE XVI

SUMMARY OF IMPROVEMENT AT .05 AND .01 LEVELS MADE BY EACH OF THE TEN CLASSES ON THE EIGHT READING AREAS

Grade	Rate	Compre-hension	Directed Reading	Word Mean-ing	Paragraph Compre-hension	Sentence Meaning	Alphabe-tizing	Use of Index
4t	.05	.01	--	--	--	--	.01	.01
4y	.01	.01	.01	--	.01	--	--	--
5t	.05	--	--	.01	--	.05	.01	.05
5y	--	--	.01	.01	--	--	--	.01
6t	.05	.01	--	--	--	.05	--	--
6y	--	.05	.05	--	--	--	--	--
7t	--	.05	--	--	--	--	.05	--
7y	--	--	--	.05	--	--	--	--
8t	.01	.01	.01	--	--	--	--	--
8y	--	.01	.01	--	--	--	--	--

TABLE XVII

SUMMARY OF DIFFERENCE OF IMPROVEMENT AT .01 AND .05 LEVELS BETWEEN CONTROL AND EXPERIMENTAL CLASSES ON THE EIGHT READING AREAS

Reading Area	Total Group	Fourth Grade	Fifth Grade	Sixth Grade	Seventh Grade	Eighth Grade
Rate	t > y = .05	----------	----------	----------	----------	----------
Comprehension	----------	y > t = .05	----------	----------	----------	----------
Directed Reading	----------	y > t = .01	----------	----------	----------	t > y = .01
Word Meaning	----------	----------	----------	----------	----------	----------
Paragraph Comprehension	----------	y > t = .01	----------	----------	----------	----------
Sentence Meaning	----------	----------	t > y = .01	y > t = .05	----------	----------
Alphabetizing	t > y = .05	----------	t > y = .05	----------	t > y = .05	----------
Use of Index	t > y = .05	----------	----------	----------	----------	t > y = .01

experimental class and the fifth-grade control class improved significantly in the use of index.

Of the ten classes involved in the study, both the experimental and control groups had nine classes showing advancement in reading test scores. Two classes improved on rate; five classes, on comprehension; four classes, on directed reading; two classes, on word meaning; one class, on paragraph meaning; no classes, on sentence meaning; two classes, on alphabetizing; and two classes, on the use of the index.

Improvement in the reading areas by the ten classes at the .05 level is also shown in Table XVI.

In Table XVII the significance of difference in improvement between the control and experimental classes is shown. For the total groups and at the sixth and seventh grade levels, there was no true difference between the amount of improvement made by the control and experimental classes.

At the fourth-grade level the control group surpassed the experimental class in improvement on directed reading and paragraph comprehension; at the fifth-grade level the experimental class improved significantly more than the control group; and at the eighth-grade level the experimental class surpassed the control class in improvement on directed reading and the use of index.

CHAPTER III

SUMMARY AND CONCLUSIONS

I. SUMMARY OF PROCEDURE

The purpose of this study was to evaluate the use of the tachistoscope as an aid in teaching reading in grades four through eight at the Hildebran School, Hildebran, North Carolina. In order to make this evaluation, an attempt was made to answer two questions: First, was there any significant progress in reading made by the classes participating in the study? Second, was there any significant difference in the amount of improvement made by those classes receiving and those not receiving instruction with the aid of the tachistoscope?

Participating in the investigation were 127 pupils in the control classes and 148 pupils in the experimental classes. When a comparison was made of the intelligence quotient means between the control and experimental groups at each of the grade levels, no significant difference in the intelligence was observed. It was assumed, therefore, that the two groups have approximately the same level of mental ability.

Before starting instruction with the tachistoscope, both the pupils who were to be taught by the use of the machine and their teachers were oriented to the purpose of

tachistoscope and the investigation. Also, prior to the instructional period, each pupil in the control and experimental groups were administered the Iowa Silent Reading Test, Form CM. At the end of the instructional period, each of the pupils was given another form (DM) of the same test. By following this procedure, teachers could measure pupil progress in eight areas of reading. Scores were obtained on reading rate, comprehension, directed reading, word meaning, paragraph comprehension, sentence meaning, alphabetizing, and the use of the index.

Classes which were designated as the control group followed their regular schedule and procedure in receiving reading instruction. Pupils in the experimental classes also received standard instruction, and, in addition, received approximately twenty minutes of drill with the tachistoscope per day over a period of fourteen weeks. In conducting the drills with the tachistoscope, the teachers who taught the experimental classes followed directions which came in a manual published by the Keystone Company, the company which sells the tachistoscope.

The plan followed was designed progressively to give the pupils more figures, numbers, words, phrases, and sentences at increased flash speed. According to the manual, the instruction would bring about improved reading through better

attention, more rapid eye fixations, increased span of apprehension, and proper left to right fixations.

In evaluating the tachistoscope as an aid in teaching reading, an attempt was made to determine whether each class in the control and experimental groups made significant progress in the eight reading areas during the period of the investigation and to determine whether classes from the experimental groups surpassed classes from the control group in reading progress in the eight reading areas. The same statistical procedure, the test for the significance of difference of means, was employed in both evaluations. The .01 level of significance was selected in the study.

II. SUMMARY OF RESULTS

Improvement by grades. The statistical analysis showed that in reading comprehension five classes improved enough to be classified as having progressed significantly at the .01 level. Of these five, three (fourth, sixth, and eighth grades) were from the experimental group, and two (fourth and eighth grades) were from the control group. Improvement for the five groups ranged from 1.8 for the eighth grade experimental group to 2.6 for the fourth-grade control group. Although the improvement made by the sixth-grade control group of 1.5 and the seventh grade experimental group of 1.9 was less than that required for significance

at the .01 level, the amount of improvement was large enough to be significant at the .05 level.

Three classes, the fourth (1.1), the fifth (1.9), and the eighth (1.9) from the control group; and the eighth grade (3.5) from the experimental group increased enough to be significant at the .01 level. Only the sixth grade from the control group improved enough (.9) to be significant at the .05 level.

On word meaning, alphabetizing, the use of the index, and rate, two classes advanced enough to be significant at the .01 level. On the first measure the experimental fifth grade advanced by 1.0, and the fifth-grade control group increased by 1.1; on the second measure (alphabetizing) the fourth and fifth grades from the experimental classes improved by 2.1 and 1.3, respectively; on the third measure (the use of the index) the fourth grade experimental class improved by 1.5, and the fifth grade control class by 1.0; and on the last measure (rate) the fourth grade control class increased in reading rate by 2.0, and the experimental eighth-grade class by 2.5.

It might be noteworthy that three experimental classes -- the fourth, fifth, and sixth grades -- improved between 1.4 and 2.2 grade levels -- progress which was significant at the .05 level.

Only the fourth grade from the experimental group made enough improvement (2.4) to be significant at the .01 level. On sentence meaning no classes made enough progress to be classified as significant at the .01 level, although the fifth- and sixth-grade experimental classes improvement of 1.5 and 1.7 was significant at the .05 level.

Difference in improvement by grades. When the experimental and control groups were compared on the amount of improvement on the eight reading measures for the total groups and by each of the five grade levels, in onlyffive out of forty-eight comparisons was there found to be enough difference to be classified as significant at the .01 level. At the fourth-grade level the control group improved significantly more than the experimental group on directed reading and paragraph comprehension; at the fifth-grade level the experimental class surpassed the control class on sentence meaning; and at the eighth-grade level the experimental class improved more than the control class in directed reading and the use of the index.

Of the seven comparisons that proved to be significant at the .05 level, five were in favor of the experimental classes. This group made more improvement than the control group when the total groups were compared on rate, alphabetizing, and the use of the index, and when the fifth and seventh

grades were compared on alphabetizing. The control group surpassed the experimental group at the .05 level on comprehension at the fourth-grade level and on sentence meaning at the seventh-grade level.

III. CONCLUSIONS AND IMPLICATIONS

There was not enough evidence to conclude that the tachistoscope was an attributing factor in reading improvement, although statistical analysis demonstrated that significant progress was made in some reading skills by a number of the ten classes participating in the study. Results indicate that both the control and experimental classes showed significant improvement in nine reading areas, but neither of the two groups demonstrated superiority over the other in improvement in a particular area. Similar results were recorded when the two groups were compared on pregress. The experimental classes surpassed those of the control classes in three reading skills; while the control classes made significantly more improvement than the experimental classes in two areas. No superiority was shown in any particular skill.

Although no superiority was shown by the classes instructed by the aid of the tachistoscope, the experiment could hardly be classified as unsuccessful. Outstanding improvement was made by many of the classes during the

relatively short period of fourteen weeks. For example, seven of the ten classes made between 1.5 and 2.6 progress in comprehension. In five cases the progress was found to be statistically significant. Also, five classes made significant improvement on directed reading; each of four classes showed a definite improvement in rate, word meaning, alphabetizing, and use of the index; and one class made significant progress on paragraph meaning.

This improvement, especially in the area of comprehension, might be attributed to the fact that great emphasis was placed on reading during the experiment and to the fact that there was a considerable amount of competition between the participating teachers and classes. If these two factors could have been controlled, results of this study might have been different.

The implication seems obvious, that conducting an experiment is one excellent technique in focusing attention on reading, and, thereby, raising the reading level of students in the public schools.

IV. RECOMMENDATIONS FOR FUTURE STUDIES

(1) Should a similar study be conducted, it is recommended that a third group, one which is not aware of the experiment, be employed. Since this additional group

would not be competing, a more exact evaluation of an applied technique can be obtained.

(2) It is further recommended that students be classified according to intelligence and reading ability in an attempt to determine whether the tachistoscope is effective with certain types of students.

(3) This experiment was conducted with students in a typical classroom situation. It is recommended that a study be conducted to determine the effectiveness of tachistoscope with smaller groups or with students having reading difficulties.

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