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ABSTRACT

This study investigated the efficacy of compressed speech with ninth and tenth grade students having reading problems. Thirty-eight ninth and tenth grade students who were reading at least one year below grade level, had an IQ between 85 and 115, and had no known gross auditory or visual defect were chosen as subjects. Three one-hour sessions were conducted to familiarize the sugjects with compressed speech. Passages II, III, and IV from the Nelson-Denny Reading Test-Revised Form B were randomly selected to be typewritten, tape-recorded at 156 words per minute, or tape-recorded at 156 words per minute and compressed to 275 words per minute by the sampling method. The results indicated that students with a reading problem had a significantly higher level of comprehension from listening to tape-recorded speech at normal speed than from reading equivalent material for an equal amount of time. It was also found that students who had difficulty in reading did not have a significantly higher level of comprehension from listening to compressed speech than from reading the equivalent material for an equal period of time. Students who have difficulty in reading did not have a significantly higher level of comprehension when speech at normal speed and compressed speed were compared. (WR)

THE EFFICACY OF COMPRESSED SPEECH AS A MEANS OF INCREASING COMPREHENSION OF CHILDREN HAVING READING PROBLEMS

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JOHN L. DAVY

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CHAPTER I

INTRODUCTION

Background.--Many of our schools depend heavily on the printed form of instructional media--mainly the textbook. This is perhaps because the textbook is one of the least expensive and most convenient forms of disseminating information to large numbers of children. Even though the printed textbook may be relatively inexpensive and may be convenient to use, it may not be the most effective means of transmitting information to many students having reading problems.

Many students in our school systems have "reading problems." These students, for various reasons, are reading at a lower level than their classmates. This inability in reading is not an isolated handicap, but has several side effects, one of which is that students who have reading problems generally have difficulty in assimilating subject matter through written materials. Therefore, these students are unable to progress at the same rate as those students without reading problems, even though they may be of normal intelligence.

Research has indicated that pupils who receive intensive instruction in remedial reading demonstrate post-remedial gains.[1] However, it has also been shown that continued growth in reading is dependent upon con-

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[1]Theodore A. Buerger, "A Follow-up of Remedial Reading Instruction," The Reading Teacher, XXI, No. 4 (January, 1968), 329-34.

tinued remedial reading.[2]

During the time the student is engaged in a remedial program, (providing such a program is available), he may not be able to progress at the same rate in subject matter areas as students who are reading at grade level if these subject matter areas are presented primarily on written materials. Thus an alternate channel for assimilation of knowledge seems justifiable.

The blind have been successfully using recorded material for many years as a means of assimilating subject matter. However, more recently, speeded speech, ("compressed speech") has been used by the blind as a rapid means of acquiring information.

Therefore, an investigation of the effects of compressed speech as a means for increasing comprehension of children having reading problems seemed worthwhile.

Statement of the problem.--The general problem was that many students having reading problems become "educationally" retarded. The specific problem of this research was to determine the efficacy of compressed speech with students of the ninth and tenth grade at Peterborough Consolidated School having reading problems.

Purpose of study.--The purpose of this study was to investigate the efficacy of compressed speech with students of the ninth and tenth grade at Peterborough Consolidated School, Peterborough, New Hampshire, having reading problems.

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[2]Bruce Balow, "The Long-Term Effect of Remedial Reading Instruction," The Reading Teacher, XVIII, No. 7 (April, 1965), 581.

Significance.--Many experiments have been conducted to determine the effectiveness of speeded speech as a means of rapidly assimilating information. Studies such as one by Orr, Friedman and Williams[3] using college subjects have shown that where 80 per cent or better of normal speeded comprehension is acceptable, even naive listeners can tolerate close to twice normal presentation speeds. Further, the results show that with 8-10 hours of training substantially higher speeds are possible.

No studies were found by this investigation to determine the effects of speeded speech upon the comprehension of children having reading problems. This investigatory study attempted to determine the efficacy of compressed speech with students having reading problems.

Delimitations.--Thirty-eight students from the ninth and tenth grade classes at Peterborough Consolidated School, Peterborough, New Hampshire, were chosen according to the following criteria:

1. Reading level at least one year below grade level.
2. An I.Q. between 85-115.
3. Chronological age between 14-17.
4. No known gross auditory or visual defects.

Definition of terms.--Compressed speech was defined in this study as an increase in word rate which had been produced by the "sampling method."

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[3]David B. Orr, Herbert L. Friedman, and Jane C. C. Williams, "Trainability of Listening Comprehension of Speeded Discourse," Journal of Educational Physchology, LVI (June, 1965), 148.

Sampling method was defined in this study as a process by which brief segments of the recorded messages are periodically delated or repeated.

Statement of Hypothesis:

1. Students who have difficulty in reading have a higher level of comprehension from listening to tape-recorded speech at normal speed than from reading equivalent material for an equal period of time.
2. Students who have difficulty in reading have a higher level of comprehension from listening to compressed speech than from reading equivalent material for an equal period of time.
3. Students who have difficulty in reading have a higher level of comprehension from tape-recorded speech at normal speed than from compressed speech for an equal period of time.

Research procedures.--Thirty-eight students from grades 9 and 10 at Peterborough Consolidated School, Peterborough, New Hampshire, were selected according to their chronological age, I.Q. level, reading level, and results of auditory and visual screenings, as stated in criteria.

Typewritten material, normal speed listening material, and compressed speech listening material were presented to this group at three different times. Comprehension of each media was measured and an analysis of variance was used to determine whether a significant difference exists at the .05 level of confidence.

A review of the literature associated with this research will be covered in Chapter II.

CHAPTER II

REVIEW OF RELATED LITERATURE

Much emphasis has been placed on reading as a means of assimilating subject matter in our school systems. Research has shown that students who have "reading problems" generally have difficulty in assimilating subject matter. Buerger[4] and Balow[5] demonstrated that reading disabilities are not corrected by short term intensive courses of treatment.

Buerger in a study designed to reveal the effects of remedial reading instruction upon the long-term post-remedial educational progress and attitudes of the pupils, chose a remedial sample consisting of 72 pupils in grades 3 through 7, who received 50 hours or more of formal remedial reading instruction. The non-remedial sample, also underachieving in reading, consisted of 72 pupils who did not receive formal reading instruction during the same period. It was found that pupils who received reading instruction demonstrated significant immediate post-remedial reading gains. However, pupils who received remedial reading instruction did not make greater long-term educational progress than the control group.

Balow summarized the results of three separate investigations which provide evidence on the effect of intensive remedial instruction for

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[4]Buerger, Op. Cit., 329-34.

[5]Balow, Op. Cit., 581.

severely disabled readers, found that severe reading disability is not corrected by short-term intensive courses of treatment, even though it is ameliorated by such help. In each instance the subjects were making progress in regular class instruction at approximately half the rate of the normal pupil. During remedial instruction, the severely disabled readers progressed at a rate 12 times their regular class rate in Sample I, and 9 times their regular class rate in Sample II. The data were not available for calculation of this figure for Sample III. While the second and third groups received additional remedial assistance throughout the follow-up period, few of the pupils in Sample I had any further special help. Sample I pupils did not lose the reading skill they had acquired, but neither did they continue to develop independently. The second and third groups were given less intensive but nonetheless supportive help over the follow-up period; these pupils continued to develop in reading at a pace more rapid than that preceding intensive tutoring. Rate growth over the follow-up period was approximately 75 per cent of normal growth.

Research such as the above, shows that normal instruction in remedial reading, unless continued for long periods of time, is not effective in increasing student comprehension in subject matter areas.

Jester and Travers[6] suggest that there exists individual differences in capability to use either auditory or visual modes of presentation. Their research was designed to investigate the comprehension of connected

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[6]Robert E. Jester and Robert M. W. Travers, "Comprehension of Connected Meaningful Discourse as a Function of Rate and Mode of Presentation," The Journal of Educational Research, LIX, No. 7 (March, 1966), 297-302.

meaningful discourse as a function of rate and mode of presentation as presented to 220 students at the University of Utah. Three modes of presentation were used—auditory, visual, and audiovisual. The five speeds of presentation were 150, 200, 250, 300 and 350 wpm. These were arranged in a 3 x 5 factorial design. Twelve subjects were randomly assigned to each of the 15 experimental conditions. The results indicate an almost linear loss in comprehension as speed is increased. The loss appears approximately linear for all modes of presentation. The audio presentation was superior to the visual for the lower speeds and the visual was superior to the audio for the higher speeds. The researchers reported that conclusions made on the basis of the data obtained in the present study must be tentative in the sense that there appears to be individual differences in capability to use either auditory or visual modes of presentation.

Foulke, Amster, Nolan and Bixler[7] conducted an experiment to determine the ability of sixth, seventh, and eighth grade Braille readers to understand rapid speech. Two types of material, one literary and one scientific, were presented to subjects in Braille and in recorded form at 175, 225, 275, 325, and 375 wpm. Comparison of mean comprehension scores for Braille readers indicated no significant loss in comprehension of literary material up through 225 wpm at the .01 level of confidence. At faster rates, the loss in comprehension became significant. There was no significant loss in comprehension of the scientific material through 275

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[7]Emerson Foulke, Clarence H. Amster, Carson Y. Nolan, and Ray H. Bixler, "The Comprehension of Rapid Speech by the Blind," Exceptional Children, XXIX (1962), 134-41.

wpm.

The results of this study show the value of being able to assimilate material through a medium other than that of reading.

Orr, Friedman, and Williams[8] suggest that time-compressed speech could increase human capacity to receive spoken language without significant loss of comprehension. In a study of 32 college students (16 in the control group and 16 in the experimental group) who received systematic practice in listening to progressively increased rates of speech from 325-475 wpm, to determine whether training with the use of distortion-free, time-compressed speech could increase human capacity to receive spoken language without significant loss of comprehension indicated that increases up to double normal rate produced no significant loss in comprehension for the experimental group. Statistically significant differences between the performance of the experimental and control groups at higher rates indicated comprehension of rapid speech to be a trainable phenomenon. The data also suggested that listening to compressed speech may have a beneficial effect on reading itself. Practice in listening to speeded speech was found to be effective as a means of improving comprehension of speeded material.

Orr and Friedman[9] conducted a brief experiment with three small groups of college students to determine the effect of listening aids on

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[8]Orr, Friedman, and Williams, "Trainability of Listening Comprehension of Speeded Discourse," 148-156.

[9]David B. Orr and Herbert L. Friedman, "The Effect of Listening Aids on the Comprehension of Time-Compressed Speech," The Journal of Communication, XVII, 223-227.

the comprehension of time-compressed speech. By providing the subjects with a summary of the message or a list of key words from the passage it was felt that the time needed to identify and process the speech sounds accurately would be reduced. The groups were matched on 175 wpm listening comprehension scores and were given a series of 5 daily practice listening sessions from Run Silent, Run Deep at 375 wpm. At the end of each practice session the subjects received one of an equated series of passages and comprehension tests drawn from a book on English colonial history. The P Group (allowed to study précis), prior to each test passage, was allowed to study a précis of the passage for two and a half minutes; the KW Group (key word) was allowed to examine a list of about 130 key words drawn from the passage; and the third group was given no listening aid.

The results indicated that the two types of listening aids employed did not improve comprehension of time-compressed speech as compared to the performance of a control group. Mean performance (at 375 wpm) did improve with practice where it was not statistically different from mean performance at 175 wpm.

Thus, the efficacy of even a very small amount of practice (about 5 hours) as a means of improving comprehension of speeded material was reconfirmed.

Another study by Orr and Friedman[10] tested the effectiveness of the time-compressed speech technique in presenting material under conditions of massed practice in listening to time-compressed speech. A small group

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[10]David B. Orr, and Herbert L. Friedman, "Effect of Massed Practice on the Comprehension of Time-Compressed Speech," The Journal of Educational Psychology, LIX (Fall, 1968), 6-11.

of subjects received practice material for about 7 hours a day for 5 consecutive days at rates of about two and a half times normal speaking rates (at 425 wpm). Passages and tests were presented daily. Results showed the comprehension increased from a mean of approximately 40 per cent of normal speed comprehension on Day 1 to a mean of 70 per cent comprehension on Day 5. While effective, the massed practice procedure produced no better performance in a total of 35 hours of practice than previous experiments using spaced practice of 1-2 hours practice.

An experimental investigation was conducted by Fairbanks, Guttman, and Miron[11] to determine the relationship between comprehension of the factual details of extended spoken messages and the rate at which they were heard.

Two technical messages, one concerned with meteorological instruments and the other with weather forecasting in support of flying were written for this experiment. The messages, 1554 words and 1573 words, respectively, were recorded at 141 wpm by an experienced male speaker.

The subjects, all Air Force trainees, were assigned to 5 experimental conditions which represented a series of compressions ranging from 0-70 per cent, and to a sixth condition (test-only) in which no message was presented.

The curve of comprehension as a function of message time was characteristically sigmoid. Response was approximately 50 per cent of maximum when message time was 40 per cent (60 per cent compression, 353 wpm),

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[11]Grant Fairbanks, Newman Guttman, and Murray S. Miron, "Effects of Time-Compression Upon the Comprehension of Connected Speech," Journal of Speech and Hearing Disorders, XXII, No. 1 (1957), 10-19.

when message time was 50 per cent (282 wpm), the response was slightly less than 90 per cent and efficiency, response per time, was maximal. Analysis of variance indicated that time compression, listener aptitude and message effectiveness all affect factual comprehension significantly, and afforded evidence that interaction of time compression and message effectiveness in the expected direction is significant.

In summary, it has been indicated through the results of the previous research that compressed speech may be used as one means of assimilating subject matter. The auditory mode of presenting subject matter has been used successfully in teaching the blind, who in effect have a problem similar to that of the students who have reading problems--that is, the inability to comprehend subject matter when it is presented in the written form. Therefore, an investigation of speeded speech as a means of increasing the comprehension of students with reading problems was appropriate at this time.

CHAPTER III

PROCEDURES

Thirty-eight students from Peterborough Consolidated School, Peterborough, New Hampshire, were chosen according to the following criteria which was established to maintain a relatively homogeneous group of ninth and tenth grade students who are reading below grade level.

1. Reading level at least one year below grade level.
2. An I.Q. between 85-115.
3. Chronological age between 14-17.
4. No gross auditory or visual defects.

The Iowa Silent Reading Test--Form AM was administered to 134 ninth grade students and 108 tenth grade students in an attempt to establish an approximate level of reading ability in terms of grade level. (See Appendix I) This test was administered during the class periods which were regularly scheduled for English classes. Those students who,for various reasons, did not take the Reading Test during their regularly scheduled English class were rescheduled to take the test in the guidance office. One student in grade 10 was blind; therefore, he was not included in this research. Eighty-four students were found to be reading one or more years below grade level. One student moved away during this research, one student was expelled from school and one student broke his leg. These three students were not included in this research.

The chronological ages of the remaining 81 students were examined and 6 students were found to be over the 17 year age limit which had been established in the limitations.

The Slosson Intelligence Test was administered to the remaining 75 students. (See Appendix I) The Slosson Intelligence Test was chosen for it was felt that a verbal intelligence test was necessary in order to achieve an I.Q. of those students who were reading below grade level. Eight students had scores above 115 and 15 students had scores below 85. These 23 students were not included in this research, for only those students with I.Q.'s which came within the range of one standard deviation above or below the mean of 100 were considered to be of average intelligence.

The remaining 52 students were screened for gross auditory and visual defects which might affect their ability to listen or to read. Audio screenings were conducted at this time for the 52 students who conformed to the previously established reading level, I.Q. range, and age range. (See Appendix I) Screenings were conducted at 25 db. on the 1964 International Standardization organization reference threshold with a Maico M-2 Pura Tone Audiometer. The frequency range was from 250 to 6,000 Hertz. One student was excluded from this research. This student had an ear infection that seriously interfered with her ability to receive audio presentations.

The remaining 51 students were screened for gross visual defects that might affect their reading ability. (See Appendix I) The 46 B Visual Survey, Keystone Telebinocular was used for the screening process. Those failing the short screening test were given the more comprehensive

screening to determine the extent of their difficulty. Twelve students were excluded from this research for vision impairment that was judged serious enough to affect their reading ability. One of the remaining 39 students failed to complete the school year and was therefore not included in this research.

Passages II, III, and IV from the Nelson-Denny Reading Test--Revised Form B were randomly selected to be typewritten, tape recorded at 156 words per minute, or tape recorded at 156 words per minute and compressed to 275 words per minute by the sampling method. These passages were selected because they were of approximately equal length and equal difficulty. The average difficulty level of each passage was indicated by the following figures which are the per cent passing the questions in the upper and lower 27 per cent of the cases used for the item analysis: Passage II--82.9, Passage III--80.3, and Passage IV--75.3. Passages II, III, and IV contain 200, 211, and 211 words respectively.

Passage IV from the Nelson-Denny Reading Test--Form B (See Appendix II) was typewritten on a Spirit-Duplicator Master. Reproductions were made with maximum clarity. The questions corresponding to Passage IV of the Nelson-Denny Reading Test--Form B (See Appendix III) were typewritten on a Spirit-Duplicator Master. Boxes were placed to the left of the possible answers, which allowed for easy scoring by the subjects.

Passage II from the Nelson-Denny Reading Test--Form B (See Appendix IV) was tape-recorded at 156 words per minute on a Rheem Califone, AV Series tape recorder at seven and one half inches per

second. The questions corresponding to Passage II (See Appendix V) were typewritten on a Spirit-Duplicator Master. Boxes were placed to the left of the possible answers, which allowed for easy scoring by the subjects.

Passage III from the Nelson-Denny Reading Test--Form B (See Appendix VI) was recorded at 156 words per minute and compressed to 275 words per minute.

The 38 subjects were asked to read Passage IV of the Nelson-Denny Reading Test--Form B. At the end of three minutes they were asked to stop. Their comprehension of this passage was measured by means of written, multiple-choice test questions from the corresponding Nelson-Denny Test. (See Appendix VII) Answers were marked by checking boxes which had been placed to the left of the possible answers. A total time of two minutes was allowed for completion of the multiple choice test questions. (See Appendix VIII)

The 38 subjects were then asked to listen to Passage II of the Nelson-Denny Reading Test--Form B, which had been tape recorded at 156 words per minute. This passage was played continuously for three minutes. Comprehension of this passage was measured by means of typewritten questions from the corresponding passage. Answers were marked on boxes which had been placed to the left of the possible answers. A total time of two minutes was allowed for completion of the multiple choice test questions. (See Appendix VIII)

A learning period of three one-hour sessions was held at this time to familiarize the subjects with compressed speech. The following works were used for the learning sessions: The House on Charlton Street by Dolard Dion, The Telltale Heart by Edgar Allen Poe, Leininger Versus The

Ants by Carl Stevenson.

The House on Charlton Street, read by Bert Blackwell was divided into 7 compressed segments of approximately 20 minutes each. The first segment was compressed to an effective rate of 200 words per minute. Each consecutive segment, separated by a 3 second pause, was increased at a rate of 10 words per minute.

The Telltale Heart was read by Jerry Fordyce and was compressed to an effective rate of 270 words per minute. The playing time of this segment was approximately 9 minutes 10 seconds.

Leininger Versus The Ants, read by Jerry Fordyce was divided into two segments. The first segment was compressed to an effective rate of 270 words per minute. The length of this segment was approximately 11 minutes 10 seconds. The second segment was compressed to an effective rate of 280 words per minute. The length of this segment was approximately 23 minutes.

The person whose voice was recorded on the tapes is a local radio and television announcer in Louisville, Kentucky. While making the recording he sat in an IAC Soundproof Chamber, Model 400, and spoke into an AKG microphone, Model D19E. A Renox Recorder, Model G36-III was used. The tape recorder was located outside the booth, and operated by a technician who also monitered the announcer's reading. The tape was recorded at 15 inches per second so that it could be reproduced on the speech compressor. The speech compressor was made at the University of Louisville, and uses a sampling wheel taken from an old Tempo Regulator. With this sampling wheel, the temporal value of the samples discarded by the compressor is 40 milliseconds. The output of the compressor was recorded

by a Crown tape recorder, Model 800.

The 38 subjects were asked to listen to Passage III of the Nelson-Denny Reading Test--Form B which had been reproduced from a master tape at the University of Louisville at a rate of 275 words per minute. This passage was played continuously for three minutes. Comprehension of this passage was measured by means of the multiple-choice test questions corresponding to Passage III. The questions corresponding to Passage III were typewritten on a Spirit-Duplicator Master. Reproductions were made with maximum clarity. Answers were marked by checking boxes to the left of the possible answers. A total time of two minutes was allowed for completion of the multiple choice test questions. (See Appendix VIII)

CHAPTER IV

PRESENTATION OF FINDINGS

The Iowa Silent Reading Test--Form AM was administered to 134 students in grade 9 and to 108 students in grade 10 at Peterborough Consolidated School. One student in grade 10 was blind; therefore, he was not included in this research. Eighty-four students were found to be reading one or more years below grade level. This was approximately 34.7 per cent of the combined population of the ninth and tenth grades. (See Table I)

TABLE I

IOWA SILENT READING TEST DATA FOR GRADES 9 AND 10

	Grade 9	Grade 10	Total
Number of students in grade	134	109	243
Number of students who took the Iowa Silent Reading Test	134	108	242
Number of students reading one or more years below grade level	53	31	84
Percentage of students reading one or more years below grade level	39.55	28.7	34.7
Mean grade equivalent reading score of students who took Iowa Silent Reading Test	9.81	10.87	
Mean grade equivalent reading score of students who were reading one or more years below grade level	7.45	7.72	
Difference between mean reading score of all students in grade and mean reading score of students reading one or more years below grade level	2.36	3.15	

The mean grade equivalent reading score of grade 9 (measured at the ninth year fifth month) was 9.81. Twenty-eight students in grade 9 were reading at a level above grade 13; however, the mean reading scores were calculated by using grade 13.0. Calculations were made using 13.0 because The Iowa Silent Reading Test did not measure grade equivalency above 13 but only measured grade 13 equivalency. The mean scores of 9.81 and 10.87 may be slightly lower than the true mean. The mean reading scores of the students in grade 10 (measured at the tenth year fifth month) was 10.87. Forty-four students were reading above grade 13, however, grade 13.0 was used for calculation of the mean. The increase in mean grade equivalent reading scores from grade 9 to grade 10 was approximately 1.06 years.

The mean grade equivalent reading scores of the 53 students of grade 9 who were reading one or more years below grade level was approximately 7.45. The mean grade equivalent reading scores of the 31 students of grade 10 who were reading one or more years below grade level was approximately 7.72. This was an increase of approximately .27 years or about 3.2 months.

One student moved away during this research, one student was expelled from school and one student broke his leg. These three students were not included in this research.

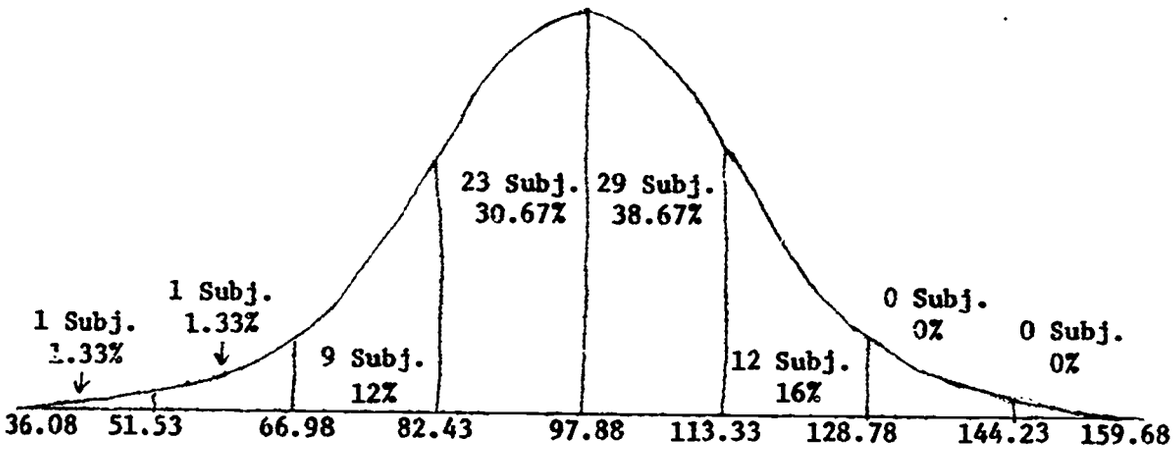
The chronological ages of the remaining 81 students were examined and 6 students were found to be over the age limit which was established in the limitations.

The Slosson Intelligence Test was administered to the remaining 75 students. The range of these scores was 77. The mean was 97.88 and the

standard deviation was 15.45. (See Table II)

TABLE II

DISTRIBUTION OF SLOSSON INTELLIGENCE TEST SCORES



Eight students had scores above 115 and 15 students had scores below 85. These 23 students were not included in this research, for only those students with I.Q.'s which came within the range of one standard deviation above or below the mean of 100 were considered to be of average intelligence.

The remaining 52 students were screened for gross auditory and visual defects which might have affected their ability to listen or to read. Twelve students were excluded for vision impairment and 1 student was excluded for a hearing loss. One of the remaining 39 students

failed to complete the school year and was therefore not included in this research.

Thirty-eight subjects read Passage IV of the Nelson-Denny Reading Test--Form B. A four-question multiple-choice test corresponding to Passage IV was administered to all subjects at the end of a three minute period. This test was designed to measure students' comprehension of Passage IV. A total time of 2 minutes was given for marking the approximate boxes. (See Appendix VIII) The range of scores was 3. The mean was approximately 1.13 and the standard deviation was approximately .86. (See Table III)

The subjects listened to Passage II of the Nelson-Denny Reading Test--Form B which had been tape-recorded at approximately 156 words per minute. Passage II was allowed to play continuously for 3 minutes. A four question multiple-choice test corresponding to Passage II was administered to all subjects. (See Appendix VIII) A total time of two minutes was given for marking appropriate boxes. The range of scores was 4. The mean was approximately 2.23. The standard deviation was approximately .98.

Three one-hour sessions were introduced at this time to familiarize the subjects with compressed speech. (See Chapter III for details.)

The subjects listened to Passage III of the Nelson-Denny Reading Test--Form B, which had been tape recorded at approximately 156 words per minute and compressed to 275 words per minute. This passage was allowed to play continuously for 3 minutes. (See Appendix VIII) A four question multiple-choice test corresponding to Passage III was administered to all subjects. A total time of 2 minutes was given for marking appropriate

boxes. The range of scores was 4. The mean was 2.0 and the standard deviation was approximately .92.

Each subject's score was the number of test items correctly answered. The means and standard deviations of these scores, for the three modes of presentation, are shown in Table III.

TABLE III

MEANS AND STANDARD DEVIATIONS OF THE THREE MODES OF PRESENTATION

Groups	Reading	Listening 156 wpm	Listening Compressed to 275 wpm
Number	38	38	38
Mean	1.13	2.23	2.0
Standard Deviation	.86	.98	.92

The mean of 2.23 of the Listening group at normal speed was nearly twice that of the Reading group. The mean of the Listening group of compressed speech was 2.0 and, as expected, was higher than that of the Reading group but lower than that of the Listening group at normal speed. The standard deviation of the Listening group at normal speed was .98 as compared with a standard deviation of .86 of the Reading group. The standard deviation of the Listening group of compressed speech was .92.

An analysis of variance of the test scores (See Table IV) indicated a significant difference at the .01 level of confidence between mean comprehension scores of the three modes of presentation.

TABLE IV

ANALYSIS OF VARIANCE OF THE MEAN COMPREHENSION SCORES OF THE THREE MODES OF PRESENTATION

Source of Variance	df	SS	MS	F	F(.01)
Between Groups	2	25.7368	12.8684	14.6949	4.80
Within Groups	111	97.2106	.8757		
Total	113	122.9474			

An analysis of variance was used to determine whether a significant difference existed between the three modes of presentation. The degrees of freedom between groups was (N-1) or 2. The degrees of freedom within groups was the total degrees of freedom (113) minus the degrees of freedom between groups. The sum of squares between groups was 25.7368 and the sum of squares within groups was 97.2106. The mean square (variance) of 12.8684 between groups was found by dividing the sum of squares by the degrees of freedom. The mean square (variance) of .8757 within groups was also found by dividing the sum of squares by the degrees of freedom. An F of 14.6949 was found by dividing the mean square between groups by the mean square within groups. According to an F table at the .01 level of confidence an F of 4.80 was significant; thereby supporting the significance of an F of 14.6949 found in this research.

Tests of t ratios for the differences in comprehension of the 3

modes of presentation (Table V) were conducted to determine where the significant difference was.

TABLE V

t RATIOS OF THE MEAN COMPREHENSION SCORES OF THE 3 MODES OF PRESENTATION

	t	df	t(.05)
Reading---Listening 156 wpm	5.1529	2	4.30
Reading---Listening Compressed to 275 wpm	4.0489	2	4.30
Listening 156 wpm--- Listening Compressed to 275 wpm	1.1039	2	4.30

A t of 5.1529 was found when the differences in mean comprehension scores of the Reading Group and the Listening Group at 156 wpm were analyzed. Hypothesis number 1 was accepted at the .05 level of confidence. Students who have difficulty in reading will have a higher level of comprehension from listening to tape-recorded speech at normal speed than from reading equivalent material for an equal period of time.

A t of 4.0489 was found when the differences in mean comprehension scores of the Reading Group and the Listening Group of compressed speech at 275 wpm. Hypothesis number 2 (that students who have difficulty in reading have a higher level of comprehension from listening to compressed speech than they have from reading equivalent material for an equal period of time) was rejected at the .05 level of confidence. A t of

4.0489 was not significant at the .05 level of confidence; however it was significant at the .10 level of confidence.

Hypothesis number three (that students who have difficulty in reading have a higher level of comprehension from tape-recorded speech at normal speed than they have from compressed speech for an equal period of time) was rejected at the .05 level of confidence. A t of 1.1039 was found. A t of 4.30 was needed for significance at the .05 level of confidence.

CHAPTER V

SUMMARY, CONCLUSIONS, RECOMMENDATIONS

Much emphasis has been placed on reading as a means of assimilating subject matter in our school systems. Research has shown that students who have "reading problems" generally have difficulty in assimilating subject matter. Buerger[12] found that pupils who received reading instruction demonstrated significant post-remedial reading gains. However, pupils who received remedial reading instruction did not make greater long-term educational progress than the control group. Balow[13] found that severe reading disability was not corrected by short-term intensive courses of treatment, even though it was ameliorated by such help. It was evident that reading should not be the primary means of disseminating information to children when research indicated that a large percentage of the children in schools have "reading problems." Jester and Travers[14] found that there appeared to be individual differences in capability to use either auditory or visual modes of presentation.

Statement of the problem.--The general problem was that many students having reading problems became "educationally" retarded. The specific problem of this research was to determine the efficacy of

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[12]Buerger, Op. Cit., 329-34.

[13]Balow, Op. Cit., 581.

[14]Jester and Travers, Op. Cit., 297-302.

compressed speech with students of the ninth and tenth grade at Peterborough Consolidated School having reading problems.

Purpose of study.--It was the purpose of this research to investigate the efficacy of compressed speech with ninth and tenth grade students at Peterborough Consolidated School, having reading problems.

Delimitations.--Thirty-eight students from the ninth and tenth grade at Peterborough Consolidated School, Peterborough, New Hampshire were chosen according to the following criteria:

1. Reading level at least one year below grade level.
2. An I.Q. between 85-115.
3. Chronological age between 14-17.
4. No known gross auditory or visual defects.

Statement of hypothesis:

1. Students who have difficulty in reading have a higher level of comprehension from listening to tape-recorded speech at normal speed than from reading equivalent material for an equal period of time.
2. Students who have difficulty in reading have a higher level of comprehension from listening to compressed speech than they have from reading equivalent material for an equal period of time.
3. Students who have difficulty in reading have a higher level of comprehension from tape-recorded speech at normal speed than they have from compressed speech for an equal period of time.

Procedure:

Passages II, III, and IV from the Nelson-Denny Reading Test--Revised Form--B were randomly selected to be typewritten, tape-recorded at 156 words per minute or tape-recorded at 156 words per minute and compressed to 275 words per minute by the sampling method. The questions corresponding to Passages II, III, and IV were typewritten on a Spirit-Duplicator Master. A learning period of three one-hour sessions was conducted to familiarize the subjects with compressed speech. This learning period was introduced prior to the compressed-speech passage taken from the Nelson-Denny Reading Test. The House on Charlton Street by Dolard Dion, The Telltale Heart by Edgar Allen Poe, and Leininger Versus the Ants by Carl Stevenson were tape-recorded at normal reading speed and compressed into 10 segments. These segments ranged from 9 minutes 10 seconds to 23 minutes in length. The first segment had been compressed to 200 words per minute. Each consecutive segment increased 10 words per minute until a maximum word rate of 280 words per minute was reached.

Findings:

An analysis of variance of the test scores indicated on F of 14.6949. According to the F table an F of 4.80 is significant at the .01 level. The F found in this research indicated that there existed a significant difference between modes of presentation.

t tests of the mean comprehension scores were conducted to determine the location of the significant difference. A t of 5.1529 was found when the differences in mean comprehension scores of the Reading Group and the Listening Group at normal speed were analyzed. Hypothesis number

1, that students who have difficulty in reading have a higher level of comprehension from listening to tape-recorded speech at normal speed than from reading equivalent material for an equal period of time, was accepted at the .05 level of confidence. This result was not surprising, for the subjects had been defined as having reading problems.

A t of 4.0489 was found when the differences in mean comprehension scores of the Reading Group and the Listening Group at compressed speech speed were examined. Hypothesis number 2, that students who had difficulty in reading have a higher level of comprehension from listening to compressed speech than from reading equivalent material for an equal period of time, was rejected at the .05 level of confidence. A t of 4.30 was significant at the .05 level of confidence. Therefore, it was shown that students who had difficulty in reading did not have a significantly higher level of comprehension from listening to compressed speech than from reading equivalent material for an equal period of time.

Hypothesis number 3, that students who have difficulty in reading have a higher level of comprehension from tape-recorded speech at normal speed than from compressed speech for an equal period of time, was rejected at the .05 level of confidence. A t of 1.1039 was found; however, a t of 4.30 was shown to be significant at the .05 level of confidence. Therefore, it was shown that students who had difficulty in reading did not have a significantly higher level of comprehension from tape-recorded speech at normal speed than from compressed speech for an equal period of time.

Conclusions:

It was found that students with reading problems had a

significantly higher level of comprehension from listening to tape-recorded speech at normal speed than from reading equivalent material for an equal length of time. It was also found that students who had difficulty in reading did not have a significantly higher level of comprehension from listening to compressed speech than from reading equivalent material for an equal period of time. Students who have difficulty in reading did not have a significantly higher level of comprehension from tape-recorded speech at normal speed than from compressed speech for an equal period of time.

Recommendations:

It was noticed during this research that students became very uneasy and restless during the 3 one-hour learning sessions. This may have been due to the length of the sessions or to the interest level of the material being presented. It was felt that future research related to compressed speech should be concerned with motivational levels of compressed speech presentations. It was felt by this researcher that future research should be concerned with the long range effects of compressed speech as an aid in the assimilation of subject matter with students who have difficulty reading.

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APPENDIX I

TESTING AND SCREENING DATA

Student	Iowa Silent-Reading Test Scores	Slosson I.Q. Scores	Vision Screening	Audio Screening	Chronological Age Screening	Other Reasons For Exclusions	Subjects
			GRADE 9				
1	8.5	92	Failed	Passed			
2	12.7						
3	10.2						
4	8.2	128					
5	8.2	91	Passed	Passed			5
6	11.8						
7	9.4						
8	6.1	88	Passed	Passed			8
9	13 plus						
10	13 plus						
11	5.9				Above 17		
12	5.3	76					
13	13 plus						
14	13 plus						
15	8.8						
16	7.3	68					
17	8.0	119					
18	7.9	66					
19	10.4						
20	8.5	114	Passed	Passed			20
21	8.2	109	Failed	Passed			

APPENDIX I—Continued

22	7.4	111	Passed	Passed			22
23	13 plus						
24	11.6						
25	7.7	94	Passed	Passed			25
26	9.4						
27	8.2	84					
28	7.7	100	Failed	Passed			
29	13 plus						
30	12.7						
31	10.4						
32	8.6						
33	11.6						
34	8.5	85	Passed	Passed			34
35	6.5	102	Passed	Passed	Left School		
36	8.2	108	Passed	Passed			36
37	7.9	93	Failed	Passed			
38	6.1	116					
39	12.1						
40	10.2						
41	9.6						
42	10.4						
43	10.0						
44	8.5	90	Passed	Passed			44
45	13 plus						
46	12.1						
47	11.6						
48	11.3						
49	13 plus						
50	8.5	124					
51	10.9						
52	9.4						
53	13 plus						
54	9.0						

APPENDIX I---Continued

55	5.9	121					
56	10.4						
57	10.9						
58	13 plus						
59	6.8	101	Passed	Passed			59
60	8.8						
61	7.9	75					
62	12.7						
63	11.6						
64	11.3						
65	9.0						
66	8.5	120					
67	11.3						
68	8.5	89	Passed	Passed			68
69	7.7	110	Passed	Passed			69
70	13 plus						
71	8.5				Above 17		
72	13 plus						
73	8.2	84					
74	8.3					Moved Away	
75	8.2	97	Passed	Passed			75
76	13 plus						
77	5.5	97	Passed	Passed			77
78	13 plus						
79	13 plus						
80	7.7	99	Passed	Passed			80
81	13 plus						
82	12.1						
83	5.4	104	Passed	Passed			83
84	9.6						
85	9.2						
86	10.2						

APPENDIX I--Continued

87	13 plus						
88	10.4						
89	7.4	104	Passed	Passed			
90	7.7	112	Passed	Passed			89
91	13 plus						90
92	13 plus						
93	13 plus						
94	13 plus						
95	10.6						
96	13 plus						
97	9.6						
98	9.4						
99	13 plus						
100	7.4	109	Passed	Passed			
101	13 plus						100
102	7.9	98	Passed	Passed			
103	7.3	93	Passed	Passed			102
104	7.0	102	Passed	Passed			103
105	7.0	86	Failed	Passed			104
106	8.3	97	Passed	Passed			
107	9.0						106
108	10.2						
109	8.0	96	Passed	Passed			
110	10.9						109
111	9.0						
112	13 plus						
113	10.2						
114	13.0						
115	6.8	84					
116	11.3						
117	13 plus						
118	10.0						

APPENDIX I--Continued

119	4.4	70					
120	12.1						
121	11.6						
122	9.4						
123	8.5	102	Passed	Passed			123
124	6.9	101	Passed	Passed			124
125	12.1						
126	7.3	108	Passed	Passed			126
127	11.6						
128	7.9	78					
129	8.0	120					
130	11.6						
131	13 plus						
132	8.5	113	Failed	Passed			
133	8.2	109	Passed	Passed			133
134	10.0						

GRADE 10

135	13 plus						
136	5.1	80					
137	11.6						
138	8.5	113	Passed	Passed			138
139	8.6	115	Passed	Passed			139
140	13 plus						
141	13 plus						
142	10.9						
143	11.6						
144	13 plus						
145	6.0	76					
146	13 plus						
147	8.5	101	Passed	Passed			147
148	11.6						

APPENDIX I--Continued

149	13 plus						
150	13 plus						
151	10.4						
152	5.9	88	Failed	Passed			
153	13 plus						
154	13 plus						
155	6.1	73					
156	13 plus						
157	9.8						
158	4.2						
159	11.3				Above 18		
160	11.6						
161	13 plus						
162	10.2						
163	7.3	83					
164	13 plus						
165	13 plus						
166	13 plus						
167	11.8						
168	13 plus						
169	13 plus						
170	13 plus						
171	13 plus						
172	10.4						
173	9.4	101	Failed	Passed			
174	12.7						
175	10.4						
176	13 plus						
177	8.6	86	Passed	Passed			177
178	6.8	90	Passed	Passed			178
179	11.6						
180	5.0	51					
181	7.9	120					

APPENDIX I--Continued

182	13 plus						
183	10.4						
184	11.6						
185	7.9				Above 17		
186	13 plus						
187	11.6						
188	12.7						
189	13 plus						
190	13 plus						
191	13 plus						
192	8.6	93	Failed	Passed			
193	11.6						
194	10.4						
195	8.3	102	Passed	Passed			195
196	13 plus						
197	13 plus						
198	9.2	101	Failed	Passed			
199	8.5				Above 17		
200	10.9						
201	13 plus						
202						Blind	
203	11.3						
204	13 plus						
205	13 plus						
206	10.9						
207	10.9						
208	10.2						
209	9.4	110	Passed	Passed			209
210	8.0					Non-member	
211	13 plus						
212	13 plus						
213	13 plus						
214	13 plus						

APPENDIX I--Continued

215	9.6						
216	7.4	77					
217	10.9						
218	7.9	96	Passed	Passed			218
219	7.7				Above 17		
220	9.2	114	Passed	Passed			220
221	13 plus						
222	9.2					Broken Leg	
223	7.9	112	Failed	Passed			
224	9.4	115	Passed	Passed			224
225	12.7						
226	13 plus						
227	11.6						
228	11.3						
229	13 plus						
230	13 plus						
231	10.9						
232	6.5	109	Failed	Passed			
233	13 plus						
234	13.0						
235	9.4	100	Passed	Passed			235
236	11.3						
237	13 plus						
238	13 plus						
239	10.4						
240	13 plus						
241	13 plus						
242	9.2	98	Passed	Failed			
243	12.1						

APPENDIX II

PASSAGE IV OF THE NELSON-DENNY READING--FORM B

The countries of the temperate zone are especially fit for the development of manufacturing industry; for the temperate zone is the region of intellectual and physical effort. If the countries of the torrid zone are little favored in reference to manufactures, they possess, on the other hand, the natural monopoly of many precious commodities which the inhabitants of the temperate climates greatly prize. A country of the torrid zone would make a very fatal mistake should it try to become a manufacturing country. Having received no invitation to that vocation from nature, it will progress more rapidly in riches and civilization if it continues to exchange its agricultural productions for the manufactured products of the temperate zone. It is true that tropical countries sink thus into dependence upon those of the temperate zone, but that dependence will not be without compensation if competition arises among the nations of temperate climes in their manufacturing industry, in their trade with the former, and in their exercise of political power. This competition not only insures a full supply of manufactures at low prices, but will prevent any one nation from taking advantage of its superiority over the weaker nations of the torrid zone.

APPENDIX III

QUESTIONS CORRESPONDING TO PASSAGE IV

I. WHAT COMPENSATION DOES THE TORRID ZONE HAVE FOR ITS LACK OF MANUFACTURING?

- [ ] 1. Articles greatly desired by the temperate zone.
- [ ] 2. Pleasure resorts.
- [ ] 3. A large commerce.
- [ ] 4. It is a region of intellectual and physical effort.
- [ ] 5. More political freedom.

II. WHAT IS THE WRITER'S ATTITUDE TOWARD DEVELOPING MANUFACTURING IN THE TORRID ZONE?

- [ ] 1. Nations of the temperate zone should encourage it.
- [ ] 2. The torrid zone should remain an agricultural land.
- [ ] 3. Private concerns should supply capital for developing manufacturing.
- [ ] 4. Manufacturing in the torrid zone means dependence.
- [ ] 5. Competition renders manufacturing there necessary.

III. WHAT POLICY SHOULD A TROPICAL COUNTRY PURSUE IN ORDER TO FOSTER ITS DEVELOPMENT AND CIVILIZATION?

- [ ] 1. Build up its manufacturing.
- [ ] 2. Increase its number of ships.
- [ ] 3. Trade its farm products for manufactured wares.

☐ 4. Establish a stable form of government.

☐ 5. Foster intellectual and physical effort in its people.

IV. WHY IS THERE SO MUCH MANUFACTURING IN THE TEMPERATE ZONE?

☐ 1. Because of its trading with the torrid zone.

☐ 2. Because the torrid zone has a monopoly of many commodities.

☐ 3. Because its governments are superior to those in the tropics.

☐ 4. Because its people possess great industry.

☐ 5. Because of vast capital.

APPENDIX IV

PASSAGE II OF THE NELSON-DENNY READING TEST--FORM B

It now became evident that the city must be abandoned at once. There was some difference of opinion in respect to the hour of departure. The daytime, it was argued by some, would be preferable, since it would enable them to see the nature and extent of their danger, and to provide against it. Darkness would be much more likely to embarrass their own movements than those of the enemy, who were familiar with the ground. A thousand impediments would occur in the night, which might prevent their acting in concert, or obeying the orders of the commander. But, on the other hand, it was urged that the night presented many obvious advantages in dealing with a foe who rarely carried his hostilities beyond the day. The late active operations of the Spaniards had thrown the Mexicans off their guard, and it was improbable they would anticipate so speedy a departure of their enemies. With celerity and caution, they might succeed, therefore, in making their escape from the town, possibly over the causeway, before their retreat should be discovered; and, could they once get beyond that pass of peril, they felt but little apprehension for the rest of the journey.

APPENDIX V

QUESTIONS CORRESPONDING TO PASSAGE II

I. WHAT IS THE MAIN TOPIC OF DEBATE MENTIONED IN THE PARAGRAPH?

- [ ] 1. Whether or not to abandon the city.
- [ ] 2. Whether to go by night or by day.
- [ ] 3. Whether to depend on speed or on caution.
- [ ] 4. Whether or not to try the causeway.
- [ ] 5. Whether they should fight or flee.

II. WHAT PLACE WAS CONSIDERED MOST DANGEROUS TO THEIR RETREAT?

- [ ] 1. City gates.
- [ ] 2. The fort.
- [ ] 3. Mexican guard house.
- [ ] 4. The causeway.
- [ ] 5. Enemy sentinel posts.

III. WHAT OBJECTION WAS URGED AGAINST A NIGHT RETREAT?

- [ ] 1. It would look cowardly.
- [ ] 2. Difficulty of transporting baggage.
- [ ] 3. Difficulty in acting in concert.
- [ ] 4. Artillery of little use.
- [ ] 5. Moon would reveal their movements.

IV. WHY WOULD THE MEXICANS PROBABLY NOT EXPECT A RETREAT?

/__/ 1. They greatly feared the Spaniards.

/__/ 2. Spanish re-enforcements were approaching.

/__/ 3. Bad weather conditions.

/__/ 4. The Spaniards had been quiet of late.

/__/ 5. The Spaniards had been lately active.

APPENDIX VI

PASSAGE III OF THE NELSON-DENNY READING TEST--FORM B

The night was cloudy, and a drizzling rain, which fell without intermission, added to the obscurity. Steadily, and as noiselessly as possible, the Spaniards held their way along the main street, which had so lately resounded to the tumult of battle. All was now hushed in silence; they were only reminded of the past by the occasional presence of some solitary corpse, or a dark heap of the slain, which too plainly told where the strife had been hottest. As they passed along the lanes and alleys which opened into the great street, they easily fancied they discerned the shadowy forms of their foe lurking in ambush, ready to spring upon them. But it was only fancy; the city slept undisturbed even by the prolonged echoes of the tramp of the horses, and the hoarse rumbling of the artillery and baggage trains. At length, a lighter space beyond the dusky line of buildings showed the van of the army that it was emerging on the open causeway. They might well have congratulated themselves on having thus escaped the dangers of an assault in the city itself, and that a brief time would place them in comparative safety on the opposite shore.

APPENDIX VII

QUESTIONS CORRESPONDING TO PASSAGE III

I. WHAT KIND OF NIGHT WAS IT?

/__/ 1. Freezing.

/__/ 2. Hot and sultry.

/__/ 3. Raining steadily.

/__/ 4. Calm and still.

/__/ 5. Frosty, starlight.

II. WHAT CAUSE FOR CONGRATULATION DID THE SOLDIERS HAVE?

/__/ 1. A renowned leader.

/__/ 2. Good horses.

/__/ 3. Enemy sentinels were asleep.

/__/ 4. Artillery and baggage were saved.

/__/ 5. They emerged from the city unmolested.

III. WHAT DID THE SOLDIERS SEE IN THEIR IMAGINATION?

/__/ 1. Their homes in Spain.

/__/ 2. Hidden enemies.

/__/ 3. Ghosts of the slain.

/__/ 4. Horses.

/__/ 5. Dark buildings.

IV. WHAT ACTIVITY IS DESCRIBED IN THE PARAGRAPH?

/__/ 1. A surprise attack.

/__/ 2. A spying party.

/__/ 3. A night march.

/__/ 4. Capture of a city.

/__/ 5. A midnight execution.

APPENDIX VIII

TEST DATA OF 38 SUBJECTS

Student	Reading Passage Score	Listening Passage Normal Speed	Listening Passage Compressed Speech	I.Q.	Grade Equivalent Reading Level	Grade
235	1	2	2	100	9.4	10
83	0	4	1	104	5.4	9
123	2	2	0	102	8.5	9
224	1	3	4	115	9.4	10
133	1	3	3	109	8.2	9
8	0	2	3	88	6.1	9
100	0	2	1	109	7.4	9
177	1	0	3	86	8.6	10
5	1	3	2	91	8.2	9
89	0	2	3	104	7.4	9
59	1	4	3	101	6.8	9
68	1	3	2	89	8.5	9
44	1	1	2	90	8.5	9
80	1	3	1	99	7.7	9
106	0	3	2	97	8.3	9
139	1	1	1	115	8.6	10
75	1	2	2	97	8.2	9
109	1	2	1	96	8.0	9
178	2	1	2	90	6.8	10
104	1	2	2	102	7.0	9
34	1	2	3	85	8.5	9
69	2	2	2	110	7.7	9
138	2	3	4	113	8.5	10
124	3	3	2	101	6.9	9
102	3	1	2	98	7.9	9
195	1	3	3	102	8.3	10
36	1	1	1	108	8.2	9
90	3	1	2	112	7.7	9
77	1	1	1	97	5.5	9
22	1	3	2	111	7.4	9
218	1	3	1	96	7.9	10
20	0	3	1	114	8.5	9
25	1	3	2	94	7.7	9
103	0	1	1	93	7.3	9
126	3	3	3	108	7.3	9
147	0	1	1	101	8.5	10
209	1	2	3	110	9.4	10
220	2	4	2	114	9.2	10