THE EFFECTS OF RATES OF COMPRESSION ON THE STUDENTS' LEARNING OF VERBALIZED CONTENT

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PREFACE

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INTRODUCTION

Introduction to the Problem

The role of the educator is to strive to teach the most to his students in a given amount of time, whether it be an hour, a unit or a semester. He should strive to teach in the best way possible so that the student can comprehend the knowledge imparted, retain and synthesize it and then be successfully tested on the material at the completion of the unit.

The problem lies in the method. What is the best and most efficient method or methods of imparting information to one's students. The standard lecture? A lecture along with related visual materials? There are numerous teaching methods with many proponents supporting each one. It is this problem which basically drew the writer's attention to the possibility of utilizing compressed speech in the delivery of verbal content.

Compressed speech is the method used in this study to shorten the delivery time of a given amount of taped information. All possible silence areas and pauses were reduced or omitted. Second, all the consonants were retained

while reducing the vowel sounds to a minimum.

It appears that the process of speech compression might serve as a feasible instructional medium. Through this form of compressed lecture, the student is presented with the identical material in a shorter period of time, thus having the duration of the remaining time saved to cover additional material or to use in another manner. Although there has been research to support the benefits and advantages of compressed speech, there have also been many studies to challenge it. It appears that more research will need to be done in this area to obtain further information.

Statement of the Problem

The problem of this study was to compare varying rates of recorded speech upon learning of three groups of university students: (1) one group listening to tapes considered to be a normal speaking rate, (2) one group listening to tapes compressed to 75% of the original delivery time, and (3) one group listening to tapes compressed to 60% of the original delivery time.

The purposes to be served by this investigation were: (1) to confirm and extend current knowledge about compressed speech and its value and use to university students and (2) to provide data regarding the use of varying rates and their effect with regard to learning value.

To achieve the purposes of the study, a total of seventy-four university students were exposed to tapes of identical content, varying only in their rate of delivery. After listening to each of the two taped lectures, the students were administered an objective type multiple choice test covering the contents of each lecture.

Definition of Terms

Normal Group:	That group of students listening to the two taped lectures at the normal speaking rate of the lecturer.
75% Group:	That group of students listening to the two taped lectures that played back at 75% of their original delivery time.
60% Group:	That group of students listening to the two taped lectures that played back at 60% of their original delivery time.
Lecture-Test I:	The first experimental session at which a lecture was presented and a test was administered.
Lecture-Test II:	The second experimental session at which a lecture was presented and a test administered.

Combined lecture-tests: The combined mean score results taken from Lecture-Test I and Lecture-Test II.

Significance of the Study

Speech compression is a relatively recent innovation due to the sophisticated technology of recent years. Limited research in the field of speech compression has been accomplished with little conclusive data to show exactly where its strengths lie and to what degree. It is felt that this particular study will contribute significant information about the subject and extend the available knowledge of the value of speech compression.

Hypotheses

For testing purposes, the hypotheses were stated in the null form:

H. 1. There will be no difference in the mean scores of the groups listening to varying rates of speech.

H. 2. The times of day at which the subjects listen to the taped lectures at varying rates of speech will have no effect upon test performance.

H. 3. There will be no interaction effect between the time of day at which the test is taken and the rate of speech to which the subjects listen upon test performance.

CHAPTER II

REVIEW OF RELATED LITERATURE

The ability to communicate effectively is probably the main quality which distinguishes a civilization. Although modern man has developed unique ways to communicate, the most widely used is still that of verbal speech.

Since the overwhelming majority of people today are probably still considered to be educationally illiterate, their only means of communicating is with verbal speech. Further, even in a highly literate society, speech is still the predominant mode of communication. Therefore, it appears that speech is definitely a powerful factor, if not the most powerful, in one's life.

A typical educational institution of higher learning probably would not exist today were it not for the educator's ability to speak, thus being able to lecture to one's students. Although many would agree that this may not be the most desirable or most efficient method, it is the most widely used way of disseminating information.

In trying to establish a more efficient way to communicate via speech, some individuals have given a great deal of thought to the supposed discrepancy between man's capability of thought and his speed of speech. It

is believed by many that the brain's capability is much greater and faster in terms of comprehension than one's speed of speech. As a result, a high degree of mind wandering and inattention is believed to take place in a conversational or listening situation due to the slowness of speech being produced and directed to the listener.

Seo (39) believes that human speech production organs can produce speech at the rate of 150 words per minute while the trained ear can comprehend compressed speech at 450 words per minute. This is nearly three times the speed of regular speech. Fairbanks, Guttman and Miron (12) cite evidence which indicates that good intelligibility is attainable when speech is compressed to 50% of the original delivery time. Pierce and David (34), however, have seriously questioned the concept that thought processes are faster than the speech process.

The concept that thought processes are significantly faster than the speaking process has caused many people to go to great lengths to study and research this question and eventually led to the concept of compressed speech. Dr. Harry Goldstein, a pioneer in altering the rate of oral material, has served as an example for subsequent studies of considerable importance. Such experimentation initially consisted mainly of rapid speaking together with a speeded playback on a tape recorder. This resulted in little or no comprehension for the listener due to the shift in higher frequency as the

rate increased. Since this proved inadequate, much thought and work went into the production of several types of highly sophisticated equipment. The VOCOM I and the Varispeech-I are examples of this technology and were used in this study.

Both the VOCOM I and the Varispeech-I are highly efficient speech compressors. They are able to shorten or eliminate pause time and/or vowel length from an original recorded taped speech or lecture. Another feature which is found in devices of this kind are controls referred to as noise controls which discriminate between the actual message and outside noises, thus being able to eliminate any detectable noises.

The Varispeech-I has an additional feature in that it is able to shorten the overall message by removing predetermined segment lengths over a variable time interval. The result is a tape which retains only the essential voice sounds necessary for understanding, thereby shortening the listening time but preserving the natural sounds of the remaining pieces.

Before proceeding into any further discussion of compressed speech, it should be clear as to what is meant by normal speech rate. Since there has been considerable controversy among researchers over differences in speaking rates of individuals, a normal speaking rate was considered in this study to be anywhere in the range of between 125 and 180 words per minute.

Emerson Foulke has done a considerable amount of research in compressed speech and a great deal of it has been with the blind. Foulke and Bixler (17) found that blind children between the ages of 11-15 years of age with no prior exposure to compressed speech, can listen to compressed speech at 275 words per minute and have good comprehension. Foulke (15) found in another study from a questionnaire distributed to 100 blind college students, that of the 51 respondents, 92% expressed a desire to listen to compressed speech for instructional purposes. There was a general preference for 275 words per minute but of those who had been in college the longest, there were preferences for rates as high as 350 words per minute.

Enc (9) gave blind adolescents material spoken at 170 and 200 words per minute and a test given after twenty-four hours showed no significant differences in comprehension or retention. Nolan (31) had different results with blind secondary school students. After presenting verbal materials to various subjects at rates of 175 and 225 words per minute, he found in all subjects and under all experimental conditions that the uncompressed speech scored significantly higher on comprehension tests than the compressed speech.

Other studies done with compressed speech and the blind tend to support the advantages of speech compression. If it can be determined that compressed speech is a

feasible educational aid for the blind, this could mean much in terms of time saved in reading Braille or listening to normal speaking taped passages.

Since intelligence, motivation and maturity seem to affect one's skill at comprehending high rates of compressed speech, it was deemed necessary to examine some of these variables. Engman (10) tested fifteen boys and girls from a junior high class for the mentally retarded after they had listened to stories at 175 and 262 words per minute. There was no significant difference found between the two rates. This finding did not seem to coincide with the commonly held belief that compressed speech rates were good only for the intelligent individual.

A study with youngsters in elementary school was undertaken by Woodcock and Clark (48) in which they classed 162 elementary school children into three levels of intelligence. The children were tested immediately after exposure to three different rates of compression and then tested one week later for their learning retention. The findings seemed to indicate that the rates of 228-328 words per minute were more efficient for learning and retention than the normal rate. Intelligence did, however, appear to play a role in the outcome since the results indicated that the most efficient rates were slower for children with lower I.Q.s than with higher I.Q.s.

Another study done by Moll (30) in which he studied rates of compression, practice effect and grade levels with elementary school children, showed that as the rate of presentation increased, comprehension decreased. Age also appeared to be a significant variable in that fifth graders comprehended compressed speech much better than first graders.

Although studies to this date have not been totally conclusive, it appears from the research that listening could possibly be a skill that can be cultivated and enhanced with regard to compressed speech. Orr (32) believes that listening can be improved significantly in this regard. He has reported that compressed speech heard at 300 words per minute without loss of comprehension is possible. He also reported that listening to 425 words per minute with 80% comprehension is attainable.

In an attempt to improve their subjects' listening skills in utilizing compressed speech, many researchers have incorporated a training or practice period into their studies. Although inconclusive, there appears to be reason to believe that a small amount of practice might be of some value. Foulke (14) undertook a study to test the effects of training with compressed speech with blind subjects. Two groups were taken separately, with one group listening to a constant delivery of 350 words per minute. This was compared to another group

whose delivery began at a slow rate and gradually increased in speed.

In a separate study, Foulke (14) varied word rates between two groups in the same way except that they were tested frequently throughout their listening period. To test the impact of the training or practice effect, a pretest and a posttest were given all groups. None of these four groups yielded any significant improvement in their ability to comprehend compressed speech. Foulke added that some of his subjects showed superior comprehension without training.

Barnard (7) also found negative results in a study he undertook to test the value of training. He found no significant gain in listening comprehension as a result of training sessions with ninety-two sixth grade children using three varying rates of both normal and compressed speech.

Friedman and Orr (20) do believe that training has some value. They conclude that comprehension can be improved by practice. Orr, Friedman and Williams (33) report that after eight to ten hours of training, substantially higher speeds were possible to comprehend. An added benefit which turned up in this study seemed to be that the students' reading skills were also significantly improved.

Friedman, Graae and Orr (19) have reported that an experimental group listening to compressed speech up

to 375 words per minute achieved, after practice, a final mean score which averaged better than 90% of normal speed score. Friedman (18) also reported that an experimental group's performance at 325 words per minute at the end of just one week's practice was not significantly different than performance at a normal speed of 175 words per minute.

Other researchers have also found a small bit of training is of significant value. Voor and Miller (44) report of a study in which fifty college psychology students listened to five taped stories with a rate of compression of 380 words per minute. There was a statistically significant improvement in comprehension over five different trial units. In two different studies performed by Resta (36) and Goldhaber (24), it was shown that comprehension improved significantly after only a two hour period of training. Woodcock (47) reports, however, that after an initial two or three exposures to rate-controlled recordings, continued practice produces little improvement in performance. As is apparent, there is still much controversy in regard to training or practice. It does appear, however, that a small amount of training might be of some value.

The problem which is generating the most questions in the field of speech compression is whether it has significant value and offers enough advantages over regular speech to be given consideration as an educational

tool. Friedman and Orr (20) conclude that compressed speech is a feasible technique in an educational setting. There are many who agree and others who do not. The answer seems to lie in the degree of compression used. Some of the research seems to indicate that the higher the compression rates, the lower the comprehension. However, Gleason, Callaway and Lakota (23) report evidence which suggests that individuals can listen and comprehend rates of 300-500 words per minute and that specially trained persons can comprehend at rates of 800-1000 words per minute. Allen and Travers (3) report similar findings in their own experiment with maximum learning occurring when the presentation rate was 400 words per minute.

Tonra (43) reports of a learning center utilizing compressed speech to help in teaching introductory psychology. Weekly lectures were prepared in either normal or compressed form. The rate of compression was as much as 45%. By means of a student questionnaire (100% response), Tonra reports that one third of the students consistently chose the compressed tapes. He also indicated that when the learning center began compressing the lecture, there was a 50% increase in the use of the lecture tape.

Anderton (4) reported no significant difference in learning between presentation rates of 150, 200, 250 and 300 words per minute. Gleason, Callaway and

Lakota (23) reported that after using tapes compressed to 175 and 225 words per minute, there was found to be no significant difference in comprehension. They conclude, therefore, that because of the time saving factor, the use of compressed speech was a far more efficient means of learning. Rossiter (37) concluded from his research that comprehension of compressed speech declines significantly at rates slower than 275 words per minute.

Short (40) conducted a study in which the student could vary the rate of the taped message at any time throughout the message. The study involved ninety undergraduate students enrolled in Nutrition and Food Science. Her main objective was aimed at time saving efficiency for the students. Short concluded that sighted students who can select their own rate of listening spend significantly less time than those who choose the normal speaking rates. Second, it was concluded that students who learn cognitive information by variable speech compression score higher on posttests than those students who learn the same information using normal speed tape recorders.

Not all findings are as positive, however. Many studies show compressed speech to be of little value in the classroom. George (21) reports that the relationship between rate of presentation and comprehension was statistically significant. He found comprehension to be the greatest following a 175 words per minute presentation and least following a 375 words per minute presentation.

Fergen (13) also reports negative findings in regard to the use of speech compression in the classroom. He had intermediate grade school children listen to compressed speech at 80, 130, 180 and 230 words per minute. His study revealed the best comprehension occurred at 130 words per minute.

Primrose (35) conducted a study at Oral Roberts University to determine the feasibility of incorporating compressed speech into their system. Research was aimed at the students' subjective feelings regarding whether they would prefer the compressed lectures because of the time saved. Primrose also wanted to determine whether the students using compressed lectures would perform as well in the course as those not using them. Rates of compression varied from 200 to 375 words per minute. Questionnaire results indicated that because of the time saved, many preferred the compression, although nearly half preferred the non-compression. No significant grade performances were discovered.

Jester (28) reports from his findings that as the rate increases the level of comprehension decreases, especially after 300 words per minute. Adelson (1) supports this finding when concluding that statistical analysis of comprehension test results showed significantly less comprehension at 257 words per minute than at 175 words per minute. Jester also relates that the questionnaire responses of his subjects reveal that

a much larger number of subjects report feelings of fatigue and anxiety under compression as opposed to normal rates of speech.

Goodman-Malamuth (25) reports of an experiment with 487 high school students being administered both easy and difficult passages of material at varying rates. Both easy and difficult passages yielded best comprehension scores at 150 words per minute.

Fairbanks, Guttman and Miron (11) have researched the effect of time compression upon intelligibility and find that intelligibility rapidly decreases as speech compression exceeds 50% of the original delivery time. Heise (26) reports that when speech is compressed to double the normal or original rate, comprehension declines with further speeding of speech, while intelligibility does not begin to drop off until 60% compression is exceeded.

Adelson (2) assessed the comprehension of 200 Brooklyn College students in a one hour lecture at 175 words per minute as compared with their comprehension of an equated time compressed lecture at 275 words per minute. Adelson reports that time-compressed materials suffered a proportionately larger loss of comprehension than did the normal rate materials when an educationally realistic length of materials was used. She was referring to a one hour period or the equivalent time it takes to deliver a normal lecture.

A main argument put forth by the supporters of compressed speech is that it is more efficient since it conveys the message to the listener in less time, therefore leaving the time saved for additional material to be learned. Sticht (42) has investigated this matter and reports of two experiments that were performed to determine whether using the time saved by the time compression process could result in additional learning. He concludes that neither repeating or extending information improved learning over that obtained by listening to uncompressed information for an equal amount of time.

Adelson (2) also questions the time efficiency of using compressed speech. She believes that compression encourages skimming, rather than probing and analyzing, and questions whether students can grasp the depth of some of the ideas presented in this method.

In another study Sticht (41) took a group of high and low aptitude men as his subjects. He administered time compressed recordings to determine if presenting new information in the time saved would improve their overall performance on a listening comprehension test. The results were again negative.

Allen and Travers (3) found that their subjects learned more when material was presented twice at 282 words per minute as opposed to once at 141 words per minute. These two operations took the same amount of time, thus indicating that the compressed rate was more

efficient than the uncompressed method. Anderton (4) reports conflicting findings in that he found no significant differences in two presentations at 300 words per minute and one presentation at 150 words per minute.

Gill (22) reports of a different approach to the problem of making use of time saved by compression. He selected six groups of subjects from an engineering class at Oklahoma State University. Two groups listened to a recorded lecture at a normal speech rate. Two other groups listened to the recorded lecture compressed to 80% of the original delivery time while two remaining groups of subjects listened to the recorded lecture at 60% of the original delivery time. Each of the three experimental speech rate groups had a matching group which differed only in the fact that there was no interim activity offered. The interim activity was offered to the experimental groups immediately after hearing the taped lecture and prior to their testing. The test which was given to all six groups covered the contents of the lecture. The other groups were tested immediately after hearing the lecture presentation.

The interim activity consisted of the student recording those conceptual points in the taped lecture he felt were most important and crucial to his understanding of the lecture. The purpose of the interim activity was to reinforce the comprehension of the content of the presentation. Gill concluded that none of the three

speech rate groups having an interim activity differed significantly in test performance than students who listened to the tape at the normal rate. Thus the time saved in speech compression for additional study did not appear to give those students a significant advantage over the students listening to normal speech.

Since the subjects in this study were university undergraduates, an effort was made to obtain some specific studies relating to college students. Barabasz (6) reports that a twenty-one minute college course lecture compressed to fourteen minutes was listened to without any significantly greater loss in recall or retention than in the case of those listening to the normal rate of presentation.

Short (40) compressed tapes at 25% and 55% of the original delivery time in teaching an elementary course in nutrition. She found no significant differences between the groups who used the compressed tapes and the group who used the normal speed tape. She also found that the students were unanimous in their conclusion that speech compression tapes should be used in the teaching of the course. Sarenpa (38) also reported positive findings while using a normal speaking rate tape and one compressed to 60% of the original delivery time. He found no significant difference in the effectiveness of the two types of tapes and thus concluded that since there was a 12.3% time savings by the compression group, it was a far more efficient means

of learning.

Libby (29) received positive attitudes from students evaluating the use of compressed speech in an auto-tutorial course in food hygiene. The students indicated that they had to concentrate harder and attend better and that they learned more when compressed speech was used. Libby believes that due to the considerable savings of time, compressed speech is far more efficient.

Hogben (27) assigned sixteen undergraduate students to listen to nine different rates of compressed speech. His results indicated that 300 words per minute was the point after which the mean comprehension level dropped significantly. Cain and Lass (8) studied the listening rate preferences of 100 college students between the rates of 100, 125, 150, 175, 200, 225, 275 and 300 words per minute. Their most preferred rate was 175 words per minute which is within the normal range.

Asher (5) found that his forty-one student subjects performed less well at all the compressed rates as opposed to the normal rate after listening to simulated news broadcasts at several different rates. Finally, Foulke (16) selected twelve comparable groups of college students. They were presented with listening rates which varied from 125 to 400 words per minute. Comprehension declined rapidly after 250 words per minute was reached. However, there was no significant loss of comprehension between the rates of 125 to 250 words per minute.

CHAPTER III

SUBJECTS, INSTRUMENTS AND METHODS OF PROCEDURE

Introduction

This chapter will present information pertinent to the subjects who participated in the study, the two instruments used, the methods utilized in collecting the data, and the methods of analyses employed in the investigation.

Subjects

The subjects investigated included a total of seventy-four undergraduate university students enrolled in Utilization of Instructional Media in the Department of Curriculum and Instruction Education at Oklahoma State University. The study was undertaken on January 28 and February 4, 1975 of the spring semester. The experimental period undertaken on January 28 will hereby be referred to as Lecture-Test I while the February 4 period will be referred to as Lecture-Test II.

Instrumentation

The two instruments used in the study were designed

by the researcher. The researcher chose to use the objective type of testing instrument since this type of test allows for more reliability in its scoring than do essay tests (44). The multiple choice type of instrument was utilized in this study. In each question the subjects were asked to choose the best two alternatives out of the choice of four presented.

The questions presented in the two testing instruments employed were chosen to evaluate the students' cognitive learning. A panel of individuals composed of two professors and two graduate assistants in the Department of Curriculum and Instruction were asked to appraise the content of the testing instruments before they were presented to the subjects for testing. They were specifically requested to judge both the questions and their related answers.

Each test consisted of seventeen multiple choice questions in which the subject had a choice of four responses. There were a total of thirty-four correct responses possible on each testing instrument. The questions were designed to test the subjects' learning of the material presented in each of the taped lectures.

Reliability

The writer calculated a split-half reliability coefficient by correlating even-item subscores with odd-item subscores (N = 74) for Lecture-Test I and

Lecture-Test II respectively. Finally, the writer calculated a split-half reliability coefficient by correlating Lecture-Test I (all items) with Lecture-Test II (all items).

Lecture-Test I

The Pearson product-moment coefficient between the split halves was .29. Applying the Spearman-Brown formula, a corrected coefficient of .45 was obtained (44).

Lecture-Test II

The Pearson product-moment coefficient between the split halves was .58. Applying the Spearman-Brown formula, a corrected coefficient of .73 was obtained.

Combined Lecture-Tests

The Pearson product-moment coefficient between Lecture-Test I and Lecture-Test II was .68. Applying the Spearman-Brown formula, a corrected coefficient of .81 was obtained.

The data for the item analyses were graded and scored by the Oklahoma State University Computer Center. The Computer Center furnished the number of subjects scoring in the upper 27% and lower 27%, discrimination index and the difficulty index. Computations were performed for both Test I and Test II.

The Difficulty Index was calculated by the following formula:

$$\text{Percent of Difficulty} = \frac{\text{Number correct on each item}}{\text{Total number of correct responses possible on each item}}$$

The Discrimination Index was calculated by the following formula:

$$\text{Discrimination} = \frac{\begin{array}{c}\text{Number of correct responses on each item for the subjects who scored in the upper (U) 27\%} \\ \text{minus} \\ \text{Number of correct responses on each item for the subjects who scored in the lower (L) 27\%}\end{array}}{\text{Number of subjects (19) = 27\% of total subjects (74)}}$$

or

$$\text{Discrimination} = \frac{U - L}{19}$$

Following are the graphs representing the Difficulty and Discrimination of both the two testing instruments.

TABLE I

ITEM DIFFICULTY INDEX AND ITEM DISCRIMINATION INDEX FOR TEST I

Item Number	Difficulty Index	Discrimination Index
1	73.0	.21
2	59.5	.32
3	87.8	.16
4	75.7	.53
5	95.9	.05
6	60.8	.26
7	93.2	.11
8	95.9	.00
9	86.5	.42
10	89.2	.11
11	50.0	.05
12	87.8	.16
13	89.2	.32
14	86.5	.47
15	95.9	.11
16	68.9	.21
17	90.5	.05
18	81.1	.26
19	90.5	.16
20	90.5	.05
21	91.9	.11
22	89.2	.11
23	93.2	.16
24	90.5	.16
25	87.8	.32
26	97.3	.05
27	85.1	.37
28	75.7	.26
29	89.2	.16
30	71.6	.47
31	64.9	.37
32	86.5	-.05
33	95.9	.11
34	70.3	.53

TABLE II

ITEM DIFFICULTY INDEX AND ITEM DISCRIMINATION INDEX FOR TEST II

Item Number	Difficulty Index	Discrimination Index
1	87.8	.16
2	74.3	.05
3	98.6	.05
4	87.8	.26
5	81.1	.32
6	86.5	.26
7	89.2	.32
8	90.5	.21
9	91.9	.26
10	98.6	.05
11	86.5	.42
12	91.9	.21
13	93.2	.21
14	90.5	.26
15	94.6	.11
16	77.0	.47
17	97.3	.05
18	86.5	.16
19	86.5	.32
20	94.6	.16
21	74.3	.42
22	75.7	.16
23	98.6	.05
24	89.2	.26
25	81.1	.37
26	91.9	.21
27	95.9	.11
28	86.5	.21
29	56.8	.37
30	89.2	.21
31	100.0	.00
32	68.9	.53
33	94.6	.16
34	97.3	.11

Methods of Procedure

The lecture-testing sessions were conducted during normal class time periods consisting of fifty minutes on January 28 and February 4, 1975. Three different sections of an undergraduate course in Curriculum and Instruction Education at Oklahoma State University were chosen for this study. Seventy-four subjects (after omissions) comprised the entire number of subjects. A small number of subjects had to be omitted from the study due to absences from one of the two controlled listening and testing times.

Another individual was omitted from the study whose native language was other than English and who could not comprehend English very well. After the data were examined, this subject's scores were found to deviate from the entire population of subjects, causing a significant degree of heterogeneity among the population means. Upon further examination of this subject's testing instruments, it was noted that this subject had difficulty in comprehending English.

Two original taped lectures comprised this study involving the three groups of students. Each of the three groups was assigned a particular speech rate which would remain the same for that group throughout both lectures.

Lecture I consisted of one professor delivering a taped body of material at all three speech rates. The

subsequent taped lecture (Lecture II) consisted of a different professor delivering a completely new body of material, again delivered in all three speaking rates of Normal, 75% compression and 60% compression. The content of both lectures consisted of information regarding instructional media pertaining directly to the course.

Each of the three sections met at a different time of day. The sections met at 8:30 a.m., 10:30 a.m., and 1:30 p.m. Each section was divided into three groups of students, selected randomly, each listening to either the normal speaking rate lecture or the same lecture compressed to 75% or 60% of the original delivery time. The individual subjects in each section were assigned a speech rate prior to the first experimental session which would remain the same for both experimental periods.

As each section met, the subjects were instructed to go to their preassigned rooms to listen to their respective rates of speech. There were equal numbers of subjects from each section to go into each speech rate group. This equality was later changed, however, by the number of omissions. The final number of subjects in each speech rate group is as appears in Table III.

A monitor was present at all times during the tape presentation and the testing situations. When the subjects arrived at their respective rooms, the monitor present played the tape for them. Immediately after the lecture tape presentation, the monitor distributed

the tests to the subjects. No discussion of any kind was permitted.

TABLE III

NUMBER OF SUBJECTS ASSIGNED TO EACH SECTION ACCORDING TO SPEECH RATE AND TIME

	NORMAL	75%	60%
8:30 Section	N = 8	N = 6	N = 7
10:30 Section	N = 11	N = 9	N = 8
1:30 Section	N = 10	N = 8	N = 7

Treatment of Data

The number of correct responses of each of the thirty-four alternatives from each of the two multiple choice tests comprised the raw data. The scores were grouped according to (1) speech rate and (2) time of day. A mean was calculated for each group according to speech rate and a separate mean was calculated for the time of day each lecture-test occurred. The obtained mean scores along with the standard deviations and the number of

subjects in each cell are shown in Tables IV, V and VI.

The population means were tested for homogeneity utilizing the F_{max} Homogeneity of Variance analysis. With 10 degrees of freedom and with 9 treatment groups, the level of significance at the .01 level is 12.4. Since the numbers in each treatment group were unequal, the largest cell frequency with a number of 11 was used. The F_{max} value reached was 10.65. Therefore, the F_{max} value was not significant, indicating homogeneity of variance among the population means (45).

Hypotheses

The hypotheses as stated in the null form for statistical testing were as follows:

H. 1. There will be no difference in the mean scores of the groups listening to varying rates of speech.

H. 2. The times of day at which the subjects listen to the taped lectures at varying rates of speech will have no effect upon test performance.

H. 3. There will be no interaction effect between the time of day at which the test is taken and the rate of speech to which the subjects listen upon test performance.

The hypotheses were tested by using an unweighted analysis of variance for each of the following: Lecture-Test I, Lecture-Test II and the combined lecture-tests. Each analysis of variance of the test score means was

TABLE IV

LECTURE-TEST I - SCORE MEANS ACCORDING TO SPEECH RATE AND TIME

	NORMAL	75%	60%	UNWEIGHTED MEANS	WEIGHTED MEANS
8:30	N=8	N=6	N=7		
	$\bar{X}$=30.25	$\bar{X}$=29.66	$\bar{X}$=26.00	$\bar{X}$=28.64	$\bar{X}$=28.66
	s.d.=2.25	s.d.=1.37	s.d.=2.52		
10:30	N=11	N=9	N=8		
	$\bar{X}$=29.63	$\bar{X}$=28.11	$\bar{X}$=28.12	$\bar{X}$=28.62	$\bar{X}$=28.71
	s.d.=3.11	s.d.=3.26	s.d.=1.25		
1:30	N=10	N=8	N=7		
	$\bar{X}$=28.70	$\bar{X}$=27.50	$\bar{X}$=26.85	$\bar{X}$=27.68	$\bar{X}$=27.42
	s.d.=2.21	s.d.=4.17	s.d.=3.44		
UNWEIGHTED MEANS	$\bar{X}$=29.53	$\bar{X}$=28.42	$\bar{X}$=26.99		
WEIGHTED MEANS	$\bar{X}$=29.48	$\bar{X}$=28.30	$\bar{X}$=27.04		

TABLE V

LECTURE-TEST II - SCORE MEANS ACCORDING TO SPEECH RATE AND TIME

	NORMAL	75%	60%	UNWEIGHTED MEANS	WEIGHTED MEANS
8:30	N=8	N=6	N=7		
	$\bar{X}$=31.75	$\bar{X}$=32.17	$\bar{X}$=27.00	$\bar{X}$=30.31	$\bar{X}$=30.29
	s.d.=2.19	s.d.=1.33	s.d.=3.74		
10:30	N=11	N=9	N=8		
	$\bar{X}$=31.81	$\bar{X}$=30.00	$\bar{X}$=30.63	$\bar{X}$=30.81	$\bar{X}$=30.89
	s.d.=2.04	s.d.=1.66	s.d.=1.85		
1:30	N=10	N=8	N=7		
	$\bar{X}$=30.20	$\bar{X}$=26.38	$\bar{X}$=28.14	$\bar{X}$=28.24	$\bar{X}$=28.40
	s.d.=1.48	s.d.=4.34	s.d.=3.34		
UNWEIGHTED MEANS	$\bar{X}$=31.25	$\bar{X}$=29.52	$\bar{X}$=28.59		
WEIGHTED MEANS	$\bar{X}$=31.24	$\bar{X}$=29.31	$\bar{X}$=28.68		

TABLE VI

COMBINED LECTURE-TESTS - SCORE MEANS
ACCORDING TO SPEECH
RATE AND TIME

	NORMAL	75%	60%	UNWEIGHTED MEANS	WEIGHTED MEANS
8:30	N=8	N=6	N=7		
	$\bar{X}$=62.00	$\bar{X}$=61.83	$\bar{X}$=53.00	$\bar{X}$=58.94	$\bar{X}$=58.95
	s.d.=4.17	s.d.=2.48	s.d.=4.80		
10:30	N=11	N=9	N=8		
	$\bar{X}$=61.45	$\bar{X}$=58.11	$\bar{X}$=58.75	$\bar{X}$=59.44	$\bar{X}$=59.60
	s.d.=4.99	s.d.=4.11	s.d.=3.01		
1:30	N=10	N=8	N=7		
	$\bar{X}$=58.90	$\bar{X}$=53.88	$\bar{X}$=55.00	$\bar{X}$=55.93	$\bar{X}$=56.20
	s.d.=3.45	s.d.=7.94	s.d.=6.38		
UNWEIGHTED MEANS	$\bar{X}$=60.78	$\bar{X}$=57.94	$\bar{X}$=55.58		
WEIGHTED MEANS	$\bar{X}$=60.72	$\bar{X}$=57.61	$\bar{X}$=55.72		

performed for all three times of day at all three speech rates. This study was a fixed effects design in regard to time of day and selected speech rates.

The .05 level of significance was selected prior to the analyses of the data as the level to be attained for rejection of the null hypotheses.

CHAPTER IV

PRESENTATION AND ANALYSIS OF THE DATA

Introduction

The presentation of the data as they pertain to the stated hypotheses will be reported in this chapter.

Hypotheses and Research Questions for Lecture-Test I

H. 1. There will be no difference in the mean scores of the groups listening to varying rates of speech.

Q. 1. Is there a difference between the groups using varying rates of speech?

The data for Lecture-Test I were analyzed using the fixed effects 3 X 3 unweighted analysis of variance. The calculated F value for Question 1 was 4.98. With 2 and 66 degrees of freedom, the F value needed for significance at the .05 level is 3.14. Therefore the question is affirmed and Hypothesis 1 is rejected. Data pertinent to this analysis are presented in Table VII.

H. 2. The times of day at which the subjects listen to the taped lectures at varying rates of speech will have no effect upon test performance.

Q. 2. Is there a difference between the times of day at which the subjects listened to the taped lectures at varying rates of speech?

TABLE VII

UNWEIGHTED ANALYSIS OF VARIANCE FOR LECTURE-TEST I COMPARING THE STUDENTS' TEST PERFORMANCE INVOLVING THREE SPEECH RATES OCCURRING AT THREE SEPARATE TIMES OF DAY

Source	SS	df	MS	F
Time	14.24	2	7.12	.92
Speech Rate	77.35	2	38.68	4.98*
Time X Speech Rate	33.37	4	8.34	1.07
Within	512.12	66	7.76	
Total	637.08	74		

*Significant at .05 level

The calculated F value for Question 2 was .92. With 2 and 66 degrees of freedom, the F value needed for significance at the .05 level is 3.14. Therefore the answer to Question 2 is negative and Hypothesis 2 is accepted. Data pertinent to this analysis are presented in Table VII.

H. 3. There will be no interaction effect between the time of day at which the test is taken and the rate of speech to which the subjects listen upon test performance.

Q. 3. Is there interaction between time of day at which the test was taken and the rate of speech presented?

The calculated F value for Question 3 was 1.07. With 4 and 66 degrees of freedom, the F value needed for significance at the .05 level is 2.51. Therefore the answer to Question 3 is negative and Hypothesis 3 is accepted. Data pertinent to this analysis are presented in Table VII.

Hypotheses and Research Questions for Lecture-Test II

H. 1. There will be no difference in the mean scores of the groups listening to varying rates of speech.

Q. 1. Is there a difference between the groups using varying rates of speech?

The data for Lecture-Test II were analyzed using the fixed effects 3 X 3 unweighted analysis of variance. The

calculated F value for Question 1 was 6.67. With 2 and 66 degrees of freedom, the F value needed for significance at the .05 level is 3.14. Therefore the answer to Question 1 is affirmed and Hypothesis 1 is rejected. Data pertinent to this analysis are presented in Table VIII.

TABLE VIII

UNWEIGHTED ANALYSIS OF VARIANCE FOR LECTURE-TEST II COMPARING THE STUDENTS' TEST PERFORMANCE INVOLVING THREE SPEECH RATES OCCURRING AT THREE SEPARATE TIMES OF DAY

Source	SS	df	MS	F
Time	88.85	2	44.43	6.78*
Speech Rate	87.40	2	43.70	6.67*
Time X Speech Rate	115.71	4	28.93	4.42*
Within	432.18	66	6.55	
Total	724.14	74		

*Significant at .05 level

H. 2. The times of day at which the subjects listen

to the taped lectures at varying rates of speech will have no effect upon test performance.

Q. 2. Is there a difference between the time of day at which the subjects listened to the taped lectures at varying rates of speech?

The calculated F value for Question 2 was 6.78. With 2 and 66 degrees of freedom, the F value needed for significance at the .05 level is 3.14. Therefore the answer to Question 2 is affirmed and Hypothesis 2 is rejected. Data pertinent to this analysis are presented in Table VIII.

H. 3. There will be no interaction effect between the time of day at which the test was taken and the rate of speech to which the subjects listen upon test performance.

Q. 3. Is there interaction between time of day at which the test was taken and the rate of speech used?

The calculated F value for Question 3 was 4.42. With 4 and 66 degrees of freedom, the F value needed for significance at the .05 level is 2.51. Therefore the answer to Question 3 is affirmed and Hypothesis 3 is rejected. Data pertinent to this analysis are presented in Table VIII.

Hypotheses and Research Questions for the Combination of Results from Lecture-Tests I and II

H. 1. There will be no difference in the mean scores

of the groups listening to varying rates of speech.

Q. 1. Is there a difference between the groups using varying rates of speech?

The data for the combined lecture-tests were analyzed using the fixed effects 3 X 3 unweighted analysis of variance. The calculated F value for Question 1 was 6.99. With 2 and 66 degrees of freedom, the F value needed for significance at the .05 level is 3.14. Therefore the question is affirmed and Hypothesis 1 is rejected. Data pertinent to this analysis are presented in Table IX.

H. 2. The times of day at which the subjects listen to the taped lectures at varying rates of speech will have no effect upon test performance.

Q. 2. Is there a difference between the time of day at which the subjects listened to the taped lectures at varying rates of speech?

The calculated F value for Question 2 was 3.72. With 2 and 66 degrees of freedom, the F value needed for significance at the .05 level is 3.14. Therefore the answer to Question 2 is affirmed and Hypothesis 2 is rejected. Data pertinent to this analysis are presented in Table IX.

H. 3. There will be no interaction effect between the time of day at which the test is taken and the rate of speech to which the subjects listen upon test performance.

Q. 3. Is there interaction between the time of day at which the test was taken and the rate of speech presented?

The calculated F value for Question 3 was 2.79. With 4 and 66 degrees of freedom, the F value needed for significance at the .05 level is 2.51. Therefore the answer to Question 3 is affirmed and Hypothesis 3 is rejected. Data pertinent to this analysis are presented in Table IX.

TABLE IX

UNWEIGHTED ANALYSIS OF VARIANCE FOR COMBINED LECTURE-TESTS COMPARING THE STUDENTS' TEST PERFORMANCE INVOLVING THREE SPEECH RATES OCCURRING AT THREE SEPARATE TIMES OF DAY

Source	SS	df	MS	F
Time	172.64	2	86.32	3.72*
Speech Rate	324.16	2	162.08	6.99*
Time X Speech Rate	258.95	4	64.74	2.79*
Within	1529.73	66	23.18	
Total	2285.48	74		

*Significant at .05 level

The data used in the analysis of Question 1, 2 and 3 were further analyzed using the Newman-Keuls Procedure. In each of the Newman-Keuls Procedures a studentized t was multiplied by the Standard Error of Mean to calculate the level of significance at the .05 level.

TABLE X

NEWMAN-KEULS PROCEDURE FOR LECTURE-TEST I INDICATING EFFECT OF SPEECH RATES UPON TEST PERFORMANCE

	60% 26.99	75% 28.42	NORMAL 29.53	t	t x $s_{\bar{X}}$
60% 26.99	-----	1.43	2.54*	3.40	1.9203
75% 28.42		-----	1.10	2.83	1.5984
NORMAL 29.53			-----		

Standard Error of Mean = .5648

*Significant at .05 level

The normal speech rate group (in Lecture-Test I) scored higher at the .05 level of significance than did the 60% compression rate group. There was no significant difference between the Normal speech rate group and the 75% compression rate group. Nor was there any significant difference between the 60% and the 75% compression rate groups.

TABLE XI

NEWMAN-KEULS PROCEDURE FOR LECTURE-TEST II INDICATING EFFECT OF SPEECH RATES UPON TEST PERFORMANCE

	60%	75%	NORMAL	t	t x $s_{\bar{X}}$
	28.59	29.52	31.25		
60% 28.59	-----	.93	2.66*	3.40	1.7643
75% 29.52		-----	1.73*	2.83	1.4685
NORMAL 31.25			-----		

Standard Error of Mean = .5189

*Significant at .05 level

The normal speech rate group (in Lecture-Test II) scored higher at the .05 level of significance than did the 60% compression rate group. In this lecture-test, the normal speech rate group also scored significantly higher than did the 75% compression rate group. There was no significant difference between the means of the 75% and the 60% compression rate groups.

TABLE XII

NEWMAN-KEULS PROCEDURE FOR COMBINED LECTURE-TESTS INDICATING EFFECT OF SPEECH RATES UPON TEST PERFORMANCE

	60%	75%	NORMAL	t	t x $s_{\bar{X}}$
	55.58	57.94	60.78		
60% 55.58	-----	2.36	5.20*	3.40	3.319
75% 57.94		-----	2.84*	2.83	2.763
NORMAL 60.78			-----		

Standard Error of Mean = .9762

*Significant at .05 level

The normal speech rate group in the combined lecture-tests scored higher at the .05 level of significance than did the 60% compression rate group. The normal speech rate group also scored significantly higher than did the 75% compression rate group. There was no significant difference between the means of the 75% and the 60% compression rate groups.

Due to the interaction between time and compression found in Lecture-Test II and the combined lecture-tests, two Newman-Keuls Multiple Comparison Procedures were performed. Data pertinent to these analyses are presented in Tables XIII and XIV.

The Newman-Keuls Multiple Comparison Procedure for Lecture-Test II revealed that the following scored higher at the .05 level of significance than the 1:30 Section, 75% compression rate (Mean = 26.38):

1. 10:30 Section, 75% compression rate (Mean = 30.00)
2. 1:30 Section, normal speech rate (Mean = 30.20)
3. 10:30 Section, 60% compression rate (Mean = 30.63)
4. 8:30 Section, normal speech rate (Mean = 31.75)
5. 10:30 Section, normal speech rate (Mean = 31.81)
6. 8:30 Section, 75% compression rate (Mean = 32.17)

The following also scored higher at the .05 level of significance than the 8:30 Section, 60% compression rate (Mean = 27.00):

1. 10:30 Section, 60% compression rate (Mean = 30.63)
2. 8:30 Section, normal speech rate (Mean = 31.75)

TABLE XIII

NEWMAN-KEULS MULTIPLE COMPARISON PROCEDURE
OF TIME OF TESTING AND RATE OF SPEECH
USED IN LECTURE-TEST II

	1:30 75% 26.38	8:30 60% 27.00	1:30 60% 28.14	10:30 75% 30.00	1:30 Norm. 30.20	10:30 60% 30.63	8:30 Norm. 31.75	10:30 Norm. 31.81	8:30 75% 32.17	t $s_{\bar{X}}$	t
1:30 75% 26.38	-----	.89	2.03	3.89*	4.09*	4.52*	5.64*	5.70*	6.06*	4.13	4.55
8:30 60% 27.00		-----	1.14	3.00	3.20	3.63*	4.75*	4.81*	5.17*	4.03	4.44
1:30 60% 28.14			-----	1.86	2.06	2.49	3.61	3.67	4.03*	3.91	4.31
10:30 75% 30.00				-----	.20	.63	1.75	1.81	2.17	3.77	4.16
1:30 Norm. 30.20					-----	.43	1.55	1.61	1.97	3.61	3.98
10:30 60% 30.63						-----	1.12	1.18	1.54	3.39	3.74
8:30 Norm. 31.75							-----	.06	.42	3.08	3.40
10:30 Norm. 31.81								-----	.36	2.57	2.83
8:30 75% 32.17									-----		

Standard Error of Mean = .9066

*Significant at .05 level

TABLE XIV

NEWMAN-KEULS MULTIPLE COMPARISON PROCEDURE
OF TIME OF TESTING AND RATE OF SPEECH
USED IN COMBINED LECTURE-TESTS

	8:30 60% 53.00	1:30 75% 53.88	1:30 60% 55.00	10:30 75% 58.11	10:30 60% 58.75	1:30 Norm. 58.90	10:30 Norm. 61.45	8:30 75% 61.83	8:30 Norm. 62.00	t $s_{\bar{X}}$	t
8:30 60% 53.00	-----	.56	2.56	5.67	6.31	6.46	9.01*	9.39*	9.56*	7.76	4.55
1:30 75% 53.88		-----	2.00	5.11	5.75	5.90	8.45*	8.83*	9.00*	7.57	4.44
1:30 60% 55.00			-----	3.11	3.75	3.90	6.45	6.83	7.00	7.35	4.31
10:30 75% 58.11				-----	.64	.79	3.34	3.72	3.89	7.09	4.16
10:30 60% 58.75					-----	.15	2.70	3.08	3.25	6.79	3.98
1:30 Norm. 58.90						-----	2.55	2.93	3.10	6.38	3.74
10:30 Norm. 61.45							-----	.38	.55	5.80	3.40
8:30 75% 61.83								-----	.17	4.83	2.83
8:30 Norm. 62.00									-----		

Standard Error of Mean = 1.7055

*Significant at .05 level

3. 10:30 Section, normal speech rate (Mean = 31.81)

4. 8:30 Section, 75% compression rate (Mean = 32.17)

The 8:30 Section, 75% compression rate (Mean = 32.17) was significantly higher than the 1:30 Section, 60% compression rate (Mean = 28.14).

The Newman-Keuls Multiple Comparison Procedure for the combined lecture-tests revealed that the following scored higher at the .05 level of significance than the 8:30 Section, 60% compression rate group (Mean = 53.00).

1. 10:30 Section, normal speech rate (Mean = 61.45)

2. 8:30 Section, 75% compression (Mean = 61.83)

3. 8:30 Section, normal speech rate (Mean = 62.00)

The following also scored higher at the .05 level of significance than the 1:30 Section, 75% compression rate (Mean = 53.88).

1. 10:30 Section, normal speech rate (Mean = 61.45)

2. 8:30 Section, 75% compression rate (Mean = 61.83)

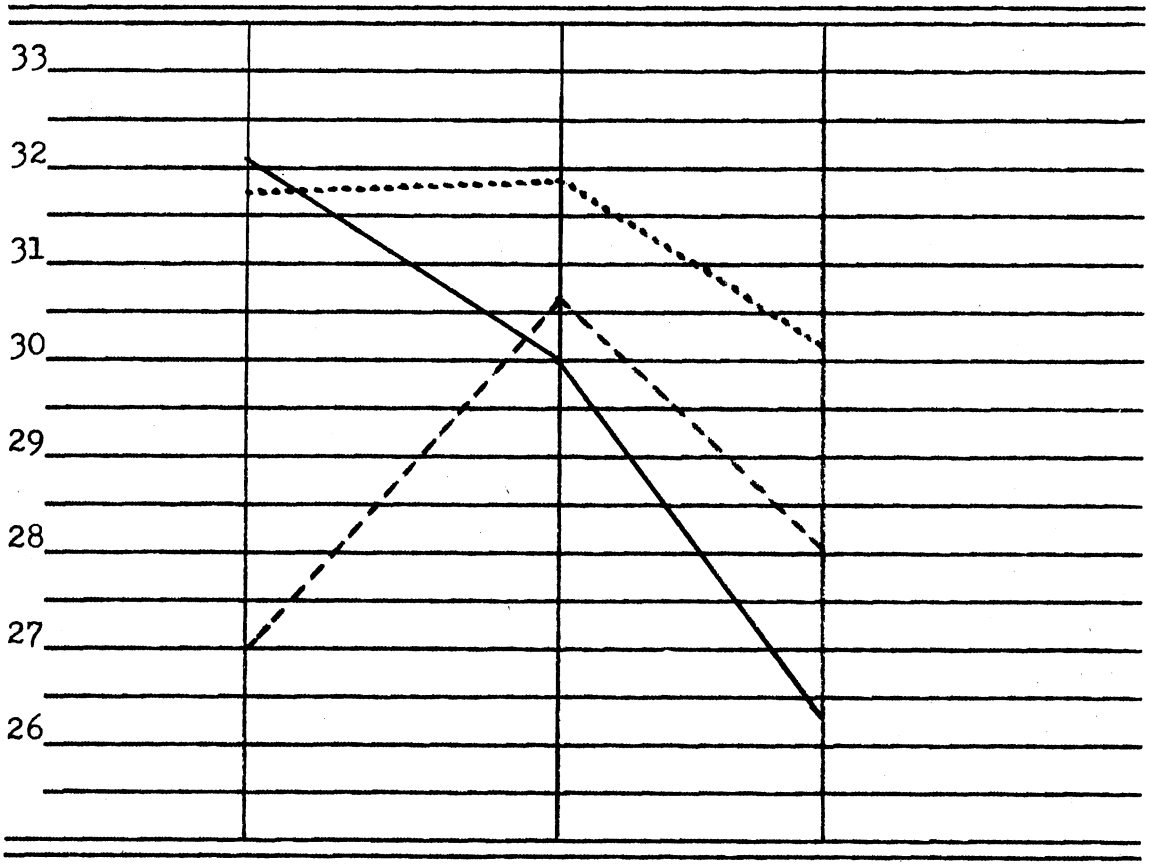
3. 8:30 Section, normal speech rate (Mean = 62.00)

To further illustrate the interaction of time and speech rate for Lecture-Test II and the combined lecture-tests, two graphs were constructed indicating the time of day at which each lecture-testing occurred and the mean scores for each speech rate group. The data are presented in Tables XV and XVI.

Interaction found in Lecture-Test II and the combined lecture-testing situations indicates that the magnitude of the means is jointly determined by both the treatment

TABLE XV

GRAPH REPRESENTING MEAN SCORES OF THE THREE SPEECH RATE GROUPS AND THE TIMES AT WHICH LECTURE-TESTING OCCURRED FOR LECTURE-TEST II



8:30 a.m. 10:30 a.m. 1:30 p.m.

MEAN SCORES:

Normal=31.75	Normal=31.81	Normal=30.20
75%=32.17	75%=30.00	75%=26.38
60%=27.00	60%=30.63	60%=28.14

LEGEND:

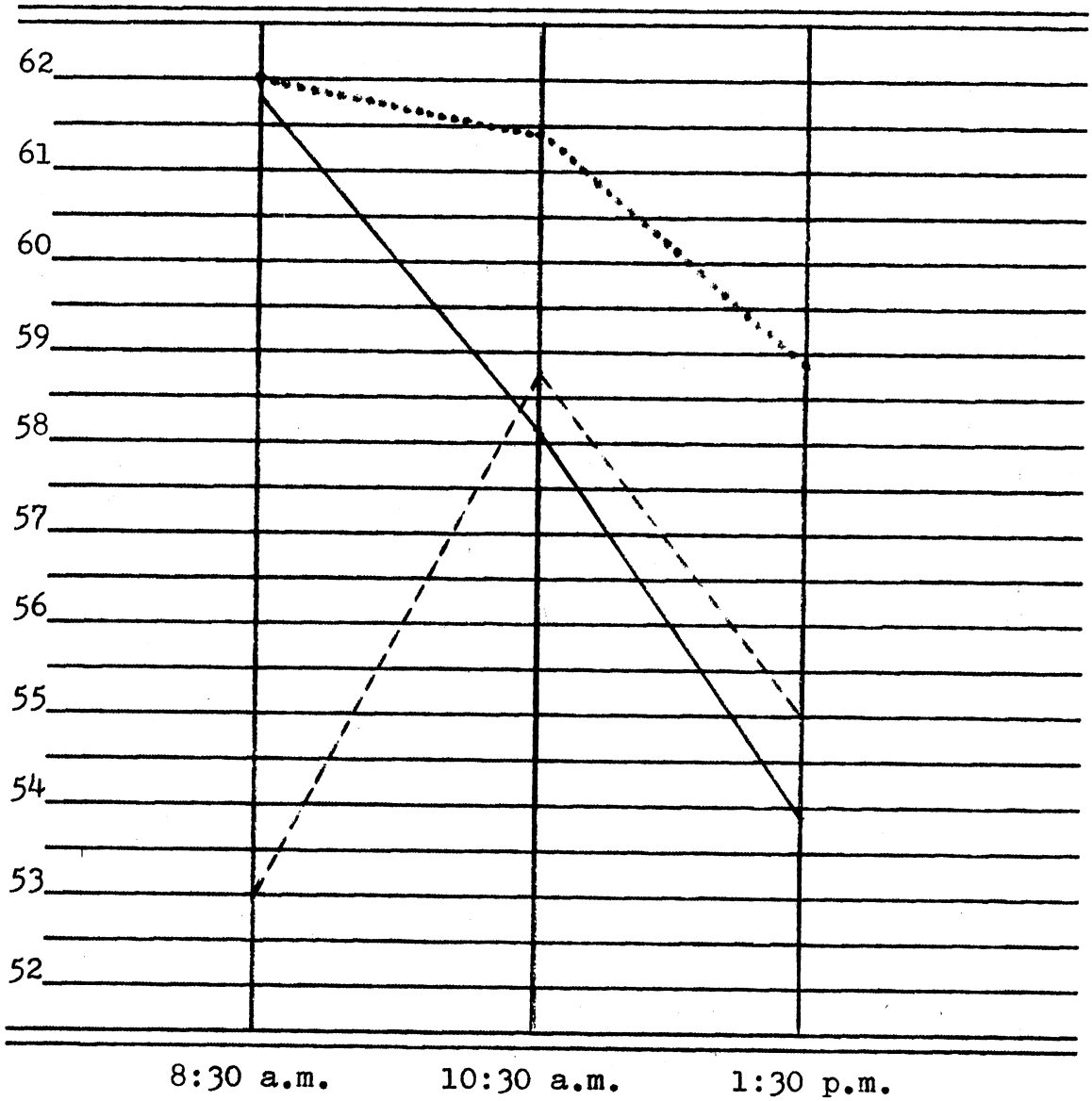
Normal.....

75%————————

60%--------------------

TABLE XVI

GRAPH REPRESENTING MEAN SCORES OF THE THREE SPEECH RATE GROUPS AND THE TIMES AT WHICH LECTURE-TESTING OCCURRED FOR COMBINED LECTURE-TESTS



MEAN SCORES:

Normal=62.00	Normal=61.45	Normal=58.90
75%=61.83	75%=58.11	75%=53.88
60%=53.00	60%=58.75	60%=55.00

LEGEND:

Normal.....
75%————————
60%----------

of the varying speech rates and the effect of the time of day at which the subjects listened to the taped lectures and were administered the tests (45).

Interaction Effect in Lecture-Test II

In the 8:30 Section there was a significant difference at the .05 level between the 60% rate mean of 27.00 and both the normal rate mean of 31.75 and the 75% rate mean of 32.17. This significant interaction indicates that the test means were not only dependent upon the various speech rates but the times at which the lecture-testing occurred. Therefore it appears that the early 8:30 a.m. time was more detrimental to the test performance of those subjects in the high compression rate of 60% than to those subjects' performance in the 75% compression rate group and the normal speaking rate group.

In the 1:30 Section there was a significant difference at the .05 level between the 75% rate mean of 26.38 and the normal speech rate mean of 30.20. The 1:30 lecture-testing time appears to have affected the significantly lower score of the 75% compression rate as compared to the score of the normal speech rate group.

There were no significant differences found in the 10:30 Section.

Interaction Effect in the Combined Lecture-Tests

It was concluded that in the 8:30 Section there was a significant difference at the .05 level between the 60% compression rate mean of 53.00 and both the 75% compression rate mean of 61.83 and the normal rate mean of 62.00. As in Lecture-Test II, it appears that the 8:30 a.m. time was effective along with the high compression rate, in causing a significant difference between those scores.

There were no significant differences found in the 10:30 Section or the 1:30 Section.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS FOR FURTHER STUDY

Introduction

The purposes of this chapter are to summarize the investigation, report the conclusions drawn from the study and to make recommendations for further research.

Summary of the Study

This study was concerned with the effects of rates of compression on the students' learning of verbalized content. The subject sample consisted of 74 undergraduate university students enrolled in an undergraduate course in Curriculum and Instruction Education at Oklahoma State University.

The two instruments utilized in this study were designed by the researcher. Each test design consisted of seventeen questions with four multiple choice alternatives. The subjects were instructed to choose the best two alternatives from the four offered. Each test utilized was designed to test the subjects' learning of a tape recorded lecture they had heard immediately before the testing.

To test the major hypotheses, this investigation divided the student subjects into three major groups of speech rate. One group was composed of subjects presented with two taped lectures at a normal rate of speech. The second group was composed of subjects presented with two taped lectures at a speech rate compressed to 75% of the original delivery time. A third group was made up of subjects listening to two taped lectures compressed to 60% of the original delivery time.

The three speech rate groups were made up of students enrolled in three different sections of the course. These sections met at three different times within the school day; 8:30 a.m., 10:30 a.m., and 1:30 p.m.

On January 28, 1975 the subjects listened to one taped lecture given by a professor in the Department of Curriculum and Instruction Education and were immediately tested for their learning of material covered in that lecture. On February 4, 1975 the students followed the same exact pattern except the taped lecture was given by a different professor in the same department covering different material. Learning of the material on the taped lectures was evaluated by the score results on the two testing instruments.

Mean scores were calculated for each speech rate group. Mean scores were also calculated for each group with regard to time of day at which the lecture-testing occurred. This was done for Lecture-Test I, Lecture-

Test II and the combined lecture-tests.

The mean scores were compared by employing a 3 X 3 fixed effects unweighted analysis of variance. The results of testing the hypotheses yielded the following:

Lecture-Test I

1. The mean score difference of the test scores of subjects using the normal speech rate, speech rate compressed to 75% of the original delivery time and speech rate compressed to 60% of the original delivery time was significant at the .05 level.

2. The mean score difference of subjects hearing the various rates of speech at different times of day was not significant.

3. There was no significant effect of interaction between the time of day nor rate of speech utilized.

Lecture-Test II

1. The mean score difference of the test scores of the subjects using normal speech rate, speech rate compressed to 75% of the original delivery time and speech rate compressed to 60% of the original delivery time was significant at the .05 level.

2. The mean score difference of subjects hearing the various rates at different times of day was significant at the .05 level.

3. There was a significant degree of interaction

between the time of day at which the lecture-testing occurred and the speech rate presented.

Combined Lecture-Tests

1. The mean score difference of the test scores of subjects using normal speech rate, speech rate compressed to 75% of the original delivery time and speech rate compressed to 60% of the original delivery time was significant at the .05 level.

2. The mean score difference of subjects hearing the various rates at different times of day was significant at the .05 level.

3. There was a significant degree of interaction between the time of day at which the lecture-testing occurred and the speech rate presented.

The Effect of Compression Rate in Lecture-Test I

The data were further analyzed to test for significant differences in learning between the three speech rate groups without the variable of time. The data were analyzed using the Newman-Keuls Procedure.

The mean difference between the normal speech rate subjects and the subjects using the 60% compression rate was significant beyond the .05 level. The mean difference between the subjects using the normal speech rate and the 75% compression rate was not significant. There

was no significant difference between the means of the subjects using 60% and 75% rates of compression.

The Effect of Compression Rate in Lecture-Test II

The mean difference between the normal speech rate subjects and the subjects using the 60% compression rate was significant beyond the .05 level of significance. The mean difference between the subjects using the normal speech rate and the 75% compression rate was also significant at the .05 level. There was no significant difference between the means of the subjects using 60% and 75% rates of compression.

The Effect of Compression Rate in Combined Lecture-Tests

The mean difference between the normal speech rate subjects and the subjects using the 60% compression rate was significant beyond the .05 level of significance. The mean difference between the subjects using the normal speech rate and the 75% compression rate was also significant beyond the .05 level of significance. Finally, there was no significant difference between the means of the subjects using 60% and 75% rates of compression.

A Newman-Keuls Multiple Comparison Procedure was employed for both Lecture-Test II and the combined lecture-tests. This was done to make comparisons between

specific mean scores of subjects in the various speech rate groups taking the test at different times to determine where the significant interaction occurred.

Interaction within Lecture-Test II

There was a significant difference in the mean scores for the following:

1. 1:30 Section, 75% compression (Mean = 26.38) and 10:30 Section, 75% compression (Mean = 30.00)

2. 1:30 Section, 75% compression (Mean = 26.38) and 1:30 Section, Normal (Mean = 30.20)

3. 1:30 Section, 75% compression (Mean = 26.38) and 10:30 Section, 60% compression (Mean = 30.63)

4. 1:30 Section, 75% compression (Mean = 26.38) and 8:30 Section, Normal (Mean = 31.75)

5. 1:30 Section, 75% compression (Mean = 26.38) and 10:30 Section, Normal (Mean = 31.81)

6. 1:30 Section, 75% compression (Mean = 26.38) and 8:30 Section, 75% compression (Mean = 32.17)

7. 8:30 Section, 60% compression (Mean = 27.00) and 10:30 Section, 60% compression (Mean = 30.63)

8. 8:30 Section, 60% compression (Mean = 27.00) and 8:30 Section, Normal (Mean = 31.75)

9. 8:30 Section, 60% compression (Mean = 27.00) and 10:30 Section, Normal (Mean = 31.81)

10. 8:30 Section, 60% compression (Mean = 27.00) and 8:30 Section, 75% compression (Mean = 32.17)

11. 1:30 Section, 60% compression (Mean = 28.14) and 8:30 Section, 75% compression (Mean = 32.17)

Interaction within Combined Lecture-Tests

There was a significant difference in the mean scores for the following:

1. 8:30 Section, 60% compression (Mean = 53.00) and 10:30 Section, Normal (Mean = 61.45)

2. 8:30 Section, 60% compression (Mean = 53.00) and 8:30 Section, 75% compression (Mean = 61.83)

3. 8:30 Section, 60% compression (Mean = 53.00) and 8:30 Section, Normal (Mean = 62.00)

4. 1:30 Section, 75% compression (Mean = 53.88) and 10:30 Section, Normal (Mean = 61.45)

5. 1:30 Section, 75% compression (Mean = 53.88) and 8:30 Section, 75% compression (Mean = 61.83)

6. 1:30 Section, 75% compression (Mean = 53.88) and 8:30 Section, Normal (Mean = 62.00)

To illustrate the interaction of time and compression for Lecture-Test II and the combined lecture-tests, graphs were presented indicating the mean scores of the three speech rates at the times tested.

There was significant difference in the mean score results for the following:

Lecture-Test II

8:30 Section: 60% and Normal
60% and 75%
10:30 Section: 75% and Normal

Combined Lecture-Tests

8:30 Section: 60% and Normal
60% and 75%

Conclusions from the Study

Hypothesis One, which states that there will be no difference in the mean scores of the groups listening to varying rates of speech, was rejected for the Normal and 60% speech rate groups in all cases. There was a significant difference in test result mean scores among all three analyses of the testing conditions.

In Lecture-Test II and the combined lecture-tests there was a significant difference between the mean scores of the Normal group and the 75% compression rate group. There was not a significant difference between the Normal and 75% compression group for Lecture-Test I.

Last, Hypothesis One was accepted for 60% and 75% compression rate groups since there were no significant differences found in any of the three analyses between the 60% and 75% compression rate score means.

The findings from the combined lecture-tests' results

indicate that normal speech rate is probably preferable for general learning than is compressed speech. It would also seem that since there appeared to be no significant difference between the 60% and 75% compression rate groups' learning, that if one were to use compressed speech as an educational tool, one should probably employ the 60% rate. This is concluded because of the time-saving advantages the 60% rate has over the 75% rate.

Hypothesis Two, which states that the times of day at which the subjects listen to the taped lectures at varying rates of speech will have no effect upon test performance, was accepted for Lecture-Test I individually. Time did not appear to have any significant effect upon the outcome in the test scores of Lecture-Test I. Hypothesis Two was rejected for Lecture-Test II and the combined lecture-tests since the time of day at which the lecture-testing occurred appeared to have a significant effect on the outcome of the test scores.

The findings from the Combined Lecture-Tests indicate that the 10:30 experiemental session scored higher than the other sessions of 8:30 a.m. and 1:30 p.m. Therefore, a tentative conclusion may be drawn that a mid-morning hour should be selected over an early morning or early afternoon time of day when utilizing compressed speech.

Hypothesis Three, which states that there will be no interaction effect between the time of day at which the test was taken and the rate of speech to which the subjects

listen upon test performance, was accepted for Lecture-Test I. There did not appear to be any significant interaction between time of day at which the lecture-testing occurred and the speech rate utilized.

Hypothesis Three was rejected, however, for Lecture-Test II and the combined lecture-tests. The 8:30 section and the 1:30 section showed significant interaction in Lecture-Test II. In the combined lecture-tests there was a significant degree of interaction found only in the 8:30 session.

The findings from the combined lecture-tests indicate that the 60% compression rate group scored significantly lower than both the other speech rate groups in the 8:30 session. A summary conclusion would be that both the difficulty of the high compression rate and the early morning hour jointly determined this result. Therefore, it might be concluded that if high rates of compression are to be utilized in educational instruction, the higher rates such as 60% compression rate, should probably be presented at a later hour than the 8:30 a.m. time.

Recommendations for Further Study

One function of an investigative study of this nature is the suggestion of further research. Following are recommendations pertaining to needed research.

1. Little, if any, research has been conducted to this date examining the effect of time of day upon students'

learning via compressed speech. Upon the undertaking of this study, it was believed that time would have no significant effect upon students' learning of verbalized content. However, since this study does indicate that time of day is a factor, it is felt that further study is needed in this area.

2. Because of the limited number of subjects represented in this study, a similar study with a larger and more representative sample should be undertaken.

3. Since the two lectures in this study were presented by two different individuals, additional research should be undertaken utilizing the same individual lecturer throughout the study. This should tend to erase the individual differences of the lecturers' speech patterns and delivery rate from the presentations and make the outcome more precise.

4. Since the present study showed no significant differences in the 60% and 75% compression rates, further studies should be undertaken to examine the time-saving and efficiency advantages of these two rates in comparison to each other.

5. Practice effect or training for the usage of compressed speech was not incorporated into this study. Since research in this area is still inconclusive, it is believed that further investigation of this would be beneficial if compressed speech is to be used in the field of education.

6. Additional research should be done examining retention span with regard to speech compression. It appears that most of the studies done thus far administer the testing instruments soon after hearing the compressed speech. It is therefore felt that this would be a worthwhile investigation.

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APPENDIX

RAW SCORES FOR TEST I AND TEST II

RAW SCORES FOR TEST ONE

	NORMAL		75%		60%	
	SUBJECT NUMBER	TEST SCORE	SUBJECT NUMBER	TEST SCORE	SUBJECT NUMBER	TEST SCORE
8:30	3	34	12	31	17	29
	6	32	9	30	21	29
	1	31	11	30	20	27
	5	31	13	30	18	26
	8	30	14	30	15	25
	7	29	10	27	16	23
	2	28	--	--	19	23
	4	27	--	--	--	--
10:30	24	33	34	32	47	30
	22	32	33	31	42	29
	27	32	35	30	45	29
	28	31	33	29	49	29
	30	31	36	29	43	27
	31	31	40	28	44	27
	32	30	41	27	46	27
	26	29	37	26	48	27
	25	28	39	21	--	--
	23	27	--	--	--	--
	29	22	--	--	--	--
1:30	51	33	61	32	72	33
	57	31	62	32	74	29
	52	30	67	31	69	28
	55	29	63	29	71	26
	59	29	60	26	70	25
	50	28	64	26	68	24
	53	28	65	23	73	23
	56	27	66	21	--	--
	54	26	--	--	--	--
	58	26	--	--	--	--

RAW SCORES FOR TEST TWO

	NORMAL		75%		60%	
	SUBJECT NUMBER	TEST SCORE	SUBJECT NUMBER	TEST SCORE	SUBJECT NUMBER	TEST SCORE
	3	34	11	34	16	32
	6	34	9	33	17	30
	5	33	12	32	15	29
	7	33	13	32	21	28
8:30	1	32	14	32	20	25
	4	30	10	30	18	23
	8	30	--	--	19	22
	2	28	--	--	--	--
	24	34	35	33	47	34
	27	34	33	31	49	32
	22	33	36	31	42	31
	25	33	38	31	45	31
	31	33	41	30	44	30
10:30	26	32	39	29	48	30
	28	32	40	29	46	29
	30	31	34	28	43	28
	32	31	37	28	--	--
	23	30	--	--	--	--
	29	27	--	--	--	--
	52	33	60	31	72	33
	51	32	63	30	69	31
	53	31	61	29	74	30
	50	30	62	29	73	28
1:30	55	30	64	26	68	26
	57	30	67	26	70	25
	59	30	65	21	71	24
	56	29	66	19	--	--
	58	29	--	--	--	--
	54	28	--	--	--	--

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