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A STUDY OF THE EFFECTS OF CONTROLLED DELIVERY INSTRUCTION UPON THE ACHIEVEMENT OF COLLEGE STUDENTS USING COMPRESSED SPEECH AUDIO AND TELEVISION PICTORIALS

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CHAPTER I

THE STUDY

INTRODUCTION TO THE STUDY

Instructional programs using student-centered methods are being designed and developed to offer alternate sources of information and alternate activities to provide more meaningful learning experiences for students than the traditional teacher-centered methods. Individual self-paced programs in which students learn from audio recordings or combinations of audio recordings with accompanying pictorials are being used in schools at all levels and in all disciplines.

Some teaching programs are totally administered by the program itself or by a teaching machine which can be operated by the students. Programmed instruction systems developed by educators such as B. F. Skinner[1], Sidney L. Pressey and Norman Crowder are individualized self-paced programs both in the linear and branched format. The programs are in print form and the student can adjust the speed of the program by the rate he chooses to read.

Programs which increase student learning levels

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[1]B. F. Skinner. "The Science of Learning and the Art of Teaching". Harvard Educational Review, 24, Spring, 1954, pp. 86-97.

are utilizing both the audio and visual channels of communication. Postlethwait[2] found students learn very well in individualized self-paced programs and attain significantly higher levels of achievement. He also found in audio tutorial programs the students not only attain higher levels of achievement but also attain these levels at a faster rate.

In contrast to the individual self-paced concept, another method of disseminating information is known as controlled delivery. Controlled delivery, or forced-pacing, is also widely used in education. It is defined as controlling the administration of the audio and visual material by a person other than the student and controlling the number of times the student may listen to the information.

Common examples of the controlled delivery method are lectures, closed circuit television, and motion picture films. These methods of presentation are extensively used in classrooms and are time-honored as effective means of transmitting information.

Automated programs which control the delivery of information in both the audio and visual channels may have a positive effect upon student achievement. It is known that students learn when the controlled method of delivery is used.

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[2]S. N. Postlethwait, J. Novak, and H. T. Murray, Jr. The Audio-Tutorial Approach to Learning Through Independent Study and Integrated Experiences (2ed.), (Minneapolis: Bugress Publishing Co., 1969).

A form of controlled reading widely used in secondary schools and colleges is found in timed-reading sessions in which the student must read a passage in a specified period of time. After reading the passage at the forced rate, the student is tested for comprehension.

Another form of forced-pacing is the controlled delivery of material which utilizes an electronic or mechanical device such as a controlled reader, teaching machine, tape recorder or television set.

Harris[3] states that a major problem ". . . is transferring the speed acquired in the practice setting to normal reading." In addition, he states " . . . the experimental evidence to date indicates that, in the elementary school, a well conceived reading program that does not use special speed-inducing devices produces as much improvement in rate as is generally attained with special instruments."

Most adults spend more than 45 percent of the working day listening to information compared to about 16 percent spent in reading.[4] Most of the material heard by adults is forced-paced. The delivery of the information is controlled. For example, television programs are a form of controlled delivery. There is no opportunity for repetition in most

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[3]A. J. Harris, E. R. Sipay. Effective Teaching of Reading. (New York: David McKay, Inc., 1971). pp. 220-221.

[4]G. D. Spache. Toward Better Reading. (Champaign, Ill: Garrard Publishing Company, 1963.) p. 181.

cases. In addition to television, motion pictures, radio, and lectures, most normal conversation is controlled and the listener is forced-paced through the material.

If effective listening is important in facilitating maximum efficiency in comprehension, then forced-pacing or controlled delivery of information is an area worthy of further investigation.

In the last five years, the use of accelerated speech programs in the audio and visual format has been investigated. These programs require less of the students' time without significant loss of intelligibility and comprehension.[5]

Nichols[6] reports the human capacity to receive information is much faster than the normal rate of conversation. He states the average college student can receive and process approximately 400 words per minute while the normal rate of conversation is approximately 150 to 175 words per minute.

Travers[7] concludes from the research information

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[5]Emerson Foulke, and Thomas G. Sticht. "Review of Research on the Intelligibility and omprehension of Accelerated Speech." Psychological Bulletin, 1969, 72. pp. 50-62.

[6]R. G. Nichols, L. A. Stevens. Are You Listening? (New York: McGraw-Hill Publishing Co., 1957).

[7]R. M. W. Travers. Man's Information System. (Scranton: Chandler Publishing Co., 1970), p. 76. (Cited from Jacobson, H. "Information and the Human Ear." Journal of the Acoustical Society of America, 1951, 23, pp. 463-471.

provided by Jacobson the ". . . brain is capable of utilizing at the highest level less than one percent of the information provided by the ear and perhaps only one part in 250,000 for the eye." In addition, from Jacobson, it was concluded, at the rate of 300 words per minute, the true transmission rate from the auditory nerves to the brain would be approximately 50 bits of information per second which represents only about one percent of the capacity of the system. A bit of information is defined by Travers as the amount of information which will reduce uncertainty between two equally probable alternative messages.[8]

There are indications from research in compressed speech (accelerated speech) by Foulke,[9] Orr and Friedman,[10] Orr, Friedman and Williams,[11] Grumpelt and Rubin,[12] and

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[8]Travers, ibid., p. 71.

[9]Emerson Foulke. "The Comprehension of Rapid Speech by the Blind--Part II". Final Progress Report, Cooperative Research Project No. 1370, Office of Education, U. S. Dept. of Health, Education, and Welfare, 1964. Eric No., ED 0003264.

[10]David B. Orr, Herbert L. Friedman. "Effect of Massed Practice on the Comprehension of Time-Compressed Speech". Journal of Educational Psychology, 1968, 59, p. 7.

[11]David P. Orr, Herbert L. Friedman, Jane C. C. Williams. "Trainability of Listening Comprehension of Speeded Discourse". Journal of Educational Psychology, 1965, 56. p 151.

[12]Howard R. Grumpelt, Ellen Rubin. "Speed Listening Skill by the Blind as a Function of Training". The Journal of Educational Research, 1972, 65. p. 470.

[13]Thomas G. Sticht. "Failure to Increase Learning Using the Time Saved by the Time Compression of Speech". Journal of Educational Psychology, 1971, 62, pp. 55-59.

Sticht,[13] that practice in listening to compressed speech does improve comprehension at accelerated rates. However, there seems to be a conflict in the finding in regard to the effect of repetition (of the same information or additional information) on comprehension at accelerated rates.

Until recently, methods of increasing word rates of audio recordings was limited to rates a narrator chose for reading the script. The rates varied from one recording to another. However, methods have now been developed to alter the word rates electronically. It is now possible to control the word rates either uniformly from one recording to another or to vary the word rates depending upon the difficulty of the material. This accelerated rate is commonly referred to as compressed speech, speeded speech, frequency controlled speech, rate controlled speech, or time-compressed speech.

Speech compression methods vary. Electronically the two major methods are:

1. pause deletion, where the electronic and the mechanical tape transport is voice actuated, resulting in a start/stop action,
2. vowel sampling, where the electronic circuits remove proportional parts of the elongated vowel sounds.

Early development and experimentation with compressed speech progressed from accelerated phonograph disc recordings by Fletcher[14] to the work of Goldstein[15] who recorded a speaker at 285 words per minute and then acceler-

ated the recording to attain 325 words per minute. Miller and Licklider[16] electronically blanked out part of the speech during recordings and Garvey[17] cut and removed very small portions of recorded tape and abutted the remaining sections together. This method produced shortened tapes thus compressing the speech without pitch distortion. Fairbanks, Everitt, and Jaeger,[18] developed an electronic instrument to accomplish, for the first time, accelerated speech patterns without pitch distortion. This development produced electronically what Garvey had accomplished by the "cut and splice" method. Previous attempts to alter the speech rates were produced by training narrators to speak at various consistant rates to maintain pitch control and more crudely by accelerating recordings at a faster rate than they were originally recorded. This produced a frequency distortion, however, the "Donald Duck Effect" recordings apparently were intelligible to a certain degree.

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[14]Harvey Fletcher. Speech and Hearing. (New York: Van Nostrand Co., 1929), pp. 293-294.

[15]Harry Goldstein. "Reading and Listening Comprehension at Various Controlled Rates." Teachers College Contributions to Education, 821. (New York: Columbia University, 1940).

[16]G. A. Miller, J. C. R. Licklider. "The Intelligibility of Interrupted Speech". Journal of the Acoustical Society of America, 1950, 22, pp. 167-173.

[17]William D. Garvey. "The Intelligibility of Speeded Speech". Journal of Experimental Psychology, 1953, 45, pp. 102-107.

With the Fairbanks electronic speech processor and similar modified instruments, it is possible to process speech is such a way that when accelerated, the speech does not experience a frequency shift. Later modifications and additional developments in electronics and mechanical combinations have improved the quality and ease of operation. These modifications have resulted in miniaturization through improved technology and transistorized circuits.

There has not been research in the area of forced-pacing coupled with compressed speech, although Orr[19] has suggested the ". . .potential utility of auditory pacing as a means of studying sensory facilitation of comprehension and reading improvement, both at the normal and remedial levels." Development of a program involving both forced-pacing and compressed speech may have great educational significance, especially if it can be shown that the combination of the two results in a significant time saving and an insignificant loss of comprehension.

STATEMENT OF THE PROBLEM

The problem of this study was to answer this question:

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[18]G. Fairbanks, W. L. Everitt, R. P. Jaeger. "Method for Time or Frequency Compression-Expansion of Speech". Transactions of the Institute of Radio Engineers, 1954, AU-2, 7-12.

[19]David B. Orr. "Recent Research of Reading and the Comprehension of Time-Compressed Speech." Proceedings of the College Reading Assn. Easton, Pa.: 7, 1966, pp. 79-84.

Will students who are forced-paced through an automated program recorded at a compressed rate achieve at a higher level than students who are self-paced through an automated program at the normal rate?

Specifically, the problem was to investigate the combination of (1) control of the mode of presentation of information (forced-pacing, self-pacing) and (2) the rate of presentation of information (compressed-rate, normal rate) that indicated the best achievement level. The achievement was determined by the mean scores resulting from the administration of a coordinated media examination upon completion of the automated audio-visual program.

POPULATION

The subjects used in this study were students enrolled in the 4001 Competency in Instructional Media course, Southwestern State College, Weatherford, Oklahoma. The study took place during the Fall, 1973 academic term. A more detailed description of the subjects is in Chapter III.

PROCEDURES

The procedure used to collect the data for the study is as follows:

1. Preparation of research materials. Automated program was recorded on 3/4 inch video tape.
2. Enrollment
3. The students were randomly assigned to four groups from the class enrollment

4. The students were given an orientation to the relevance of Media Competency in the teacher training program

5. All students were given the opportunity to listen to a compressed speech listening sampler

6. Administration of automated media program to all groups

7. Evaluation (final examination on the entire automated media course)

8. Treatment of the data

9. Summary of the findings

A more detailed procedure and design of the study is found in Chapter III.

PURPOSE OF THE STUDY

The concept of forced-pacing in conjunction with compressed speech provides a dual time-saving sequence when studying audio materials. Students who can master this sequence through training and practice, may enjoy additional time not previously available to them. Through wise management of this time, students will be able to learn more material through individual study, improve their study styles, and have time left for meaningful discussions.

In addition to the student time advantage, the institution benefits by having the option of scheduling the instructional facility for more short periods during the day without destroying the course content or organization. More classes can be scheduled during these time periods, or small group discussion periods with the professor can

be added during the time saved, thus adding the human element to the automated program.

SIGNIFICANCE OF THE STUDY

In higher education, limited research has been done which investigates long duration programmed studies using compressed speech as the audio medium and television as the pictorial medium. A study made by Loper[20] in which comprehension and retention was measured using only audio and audio with televised pictorials substantiated that televised pictorials did not provide much assistance to an aural presentation. The material was not, however, from an organized course administered over a long duration.

Travers[21] reported at normal speech rates no advantage was found for the audio visual presentation as compared to using only audio, but added at higher speech rates the audio visual channel proved to be superior to audio only. This finding tends to support the need for further evidence in the use of compressed audio tracks in conjunction with televised pictorials for group forced-paced learning situations.

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[20]J. L. Loper. "An Experimental Study of Some Effects of Time-Compression Upon the Comprehension and Retention of a Visually augmented Televised Speech." Unpublished Doctoral Dissertation, University of California, 1966.

[21]R. M. W. Travers. "The Transmission of Information to Human Receivers." Audio Visual Communications Review, 1964, 12, pp. 373-385.

Most of the research has been done on listening comprehension and intelligibility of compressed speech. More research has been done using word lists, definitions, and short passages than using connected discourse. Significant research has been more in the area of the elementary of secondary school, with blind children and with armed forces personnel. In higher education, Dr. Barlow J. Wagman, University of Maryland School of Dentistry considered compressed speech programs to impart factual information in the curriculum courses, Public Health Administration, Epidemiology, and Biostatics.[22] Dr. Bruce M. Haas at the University of Hawaii prepared coursework in Real Estate Principles using compressed speech techniques with filmstrips and tape narration.[23]

There are four important areas for which this study may be significant:

1. The growing emphasis in higher education toward mediated instruction provides the impetus necessary to promote the research for improvement in presentation methods;

2. Compressed speech has proved feasable in presenting information to students in a shorter time duration without significant loss in comprehension at moderately accelerated speeds,

3. The lack of research in forced-pacing supports this study since the emphasis at the present is on self-pacing individual study, and

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[22]Newsletter, Center for Rate Controlled Recordings, Louisville, Kentucky, November 15, 1972, 6, p 3.

[23]Newsletter, Center for Rate Controlled Recordings, Louisville, Kentucky, March 15, 1973, 7, p 3.

4. There is a lack of research in the area of organized course instruction of long duration in higher education using compressed speech at either self-paced rates or group forced-paced rates.

The transcription of a compressed speech audio track in conjunction with the video transcription of a filmstrip eliminates a manual responsibility previously left to the student. This manual operation of the slide advance may distract the student since he may listen for the electronic advance tone instead of to the information presented. The only manual operation the student performs is note-taking, and then only if he wishes.

The main advantage of compressed audio material is that it allows a reduction in time investment without a reduction in content. This phenomenon has pronounced implications in education, especially when applied in a learning environment with individual or group instruction. The laboratory facilities, utilized for shorter periods, will be available for increased student usage of space and equipment. Students, too, will have opportunities to spend less time in listening to specified recorded materials and more time in gathering additional information from alternate sources, assimilating the information, and having meaningful group discussions.

HYPOTHESES

Four main null hypotheses and four related hypotheses were tested in the study:

Ho_1 - There is no significant difference between the mean scores of students who are forced-paced through an automated program and those who are self-paced through an automated program.

Ho_2 - There is no significant difference between the mean scores of students who receive the compressed version of the automated program and those who receive the normal rate version.

Ho_3 - There is no significant interaction between the mode of presentation and the rate of presentation of the program.

Ho_4 - There is no significant difference between the achievement of students classified as high achievers and those who are classified as low achievers when the pacing is controlled and the program rate is controlled.

Ho_5 - There is no significant difference between the achievement of male students who receive the compressed version of the automated program in both modes of presentation and those who receive the

normal rate version in both modes of presentation.

Ho_6 - There is no significant difference between the achievement of female students who receive the compressed version of the automated program in both modes of presentation and those who receive the normal rate version in both modes of presentation.

Ho_7 - There is no significant difference between the achievement of male and the achievement of female students who receive the compressed version of the automated program and those who receive the normal rate version of the automated program in the forced-paced mode.

Ho_8 - There is no significant difference between the achievement of male and the achievement of female students who receive the compressed version of the automated program and those who receive the normal rate version of the automated program in the self-paced mode.

STATISTICAL TREATMENT

A 2 x 2 factorial analysis of variance was computed to test for significant differences between the means of the groups and the interaction effects.

Additional 2 x 2 factorial analyses were computed for the following:

1. Achievement scores of students who have grade point averages in the upper and lower 1/3 of the group population versus the self-paced normal and the self-paced compressed rates of speech.

2. Achievement scores of students who have grade point averages in the upper and lower 1/3 of the group population versus the forced-paced normal and the forced-paced compressed rates of speech.

3. Achievement scores of students who have grade point averages in the upper 1/3 of the group population versus the forced-paced and self-paced mode of presentations.

4. Achievement scores of students who have grade point averages in the lower 1/3 of the group population versus the forced-paced and self-paced mode of presentations.

5. Achievement scores of students who scored in the upper and lower 1/3 on the comprehension section of the Nelson-Denny Reading Test versus the self-paced normal and self-paced compressed rates of speech.

6. Achievement scores of students who scored in the upper and lower 1/3 on the comprehension section of the Nelson-Denny Reading Test versus the forced-paced normal and forced-paced compressed rates of speech.

7. Achievement scores of students who scored in the upper and lower 1/3 on the SCAT (School-College Aptitude Test) versus the self-paced normal and self-paced compressed rates of speech.

8. Achievement scores of students who scored in the upper and lower 1/3 on the SCAT versus the forced-paced normal and forced-paced compressed rates of speech.

9. Achievement scores of male students in both modes of presentation and in both rates of presentation.

10. Achievement scores of female students in both modes of presentation and in both rates of presentation.

11. Achievement scores of males versus female in the forced-paced mode of presentation and both rates of presentation.

12. Achievement scores of males versus female in the self-paced mode of presentation and both rates of presentation.

Correlations were computed to detect relationships between grade point averages, School College Aptitute Test, Nelson-Denny Comprehension and Vocabulary Scores and the achievement scores in each of the four groups.

DEFINITIONS OF TERMS USED

1. Compressed Speech - Shortened speech messages by deleting the pauses between words and phrases and by deleting part of the vowel sounds. The result is a shortened length of material without loss of content and without a frequency shift.

2. Sampling - Segments of recorded speech are periodically dropped and the resulting gaps are closed.

3. Compression Rate - Compression rates are sometimes reported in percentage of material not compressed, i. e., 75% of the original material is still audible. Sometimes the compression rate is given in percentage of material deleted. Often the compression rate is reported as an acceleration rate such as 1.2 times the original word rate. Frequently the compression rate is reported as words per minute, such as 282 wpm. This is the safest way to report the compression rate since the normal rate of speech varies.

4. Intelligibility - The ability to repeat a word. word phrase or short sentences correctly. Intelligibility of the words is used in conjunction with understandability.

5. Long Duration Course - A curriculum course administered over a school semester or term.

6. Forced-Pacing - Controlling the administration of information by an operator other than the subject. The operator also has control over the number of times the information is heard and the rate of presentation of the information.

7. Self Pacing - The student has control of the rate in which the material is administered.

DELIMITATIONS OF THE STUDY

The delimitations of the study are as follows:

1. The subjects were teacher education students enrolled in the Instructional Media Competency 4001 at

Southwestern State College, Weatherford, Oklahoma, Fall, 1973.

2. Four groups of 20 students were formed from the enrollment by random assignment. The remaining students in the population were not used in the study.

3. The grade-point averages of the students ranged from 2.02 to 3.95 based on a 4 point grading system where 4.00 is equivalent to the letter grade A, 3.00 is the letter grade B, 2.00 is the letter grade C and 1.00 is the letter grade D.

4. The achievement groups were designated as follows:

2.02 - 2.81 low achievers
2.82 - 3.25 moderate achievers
3.26 - 3.95 high achievers

LIMITATIONS OF THE STUDY

The limitations of the study included a dependence upon the random assignment of students enrolled in the media competency course at Southwestern State College to make four groups with a complement of 20 students each. In addition, the program was limited to a programmed automated filmstrip-sound course in media education developed by W. R. Fulton at the University of Oklahoma. The program was transcribed to 3/4 inch video tape. A posttest developed at the University of Oklahoma was used as the test instrument.

ORGANIZATION OF THE DISSERTATION

The dissertation is organized into five chapters.

Chapter I. The Study. In this Chapter the rationale for the study will be presented. It includes the statement of the problem, the hypotheses tested, the purpose of the study and the significance of the study, the limitations and the population.

Chapter II. A Review of the Literature. This Chapter relates background material in compressed speech technology and research relating to compressed speech intelligibility and comprehension.

Chapter III. Procedures in Research Design. The specific procedures of the study are listed in this chapter. The overall plan for the study and the research design are also included.

Chapter IV. Statistical Analysis of the Data. The collection and interpretation of the data is presented.

Chapter V. Summary, Recommendations and Implications of the Research. The research findings, the research implications and recommendations for further research are included in this chapter.

Bibliography

Appendicies

CHAPTER II

REVIEW OF THE LITERATURE

TECHNOLOGY

Many early attempts were made to accelerate the rate of presentations of connected discourse, from spinning wax records at a rate faster than originally recorded to training a speaker to narrate at constant rates. It was known as early as 1955 the human mind could assimilate information much faster than the oral communication was received. Nichols[1] estimated the ". . . average cruising speed of thought for most college classes would be at least 400 words per minute." Equated in terms of compression rates, this would compute to approximately 69 percent compression from a normal rate of 125 words per minute or approximately 57 percent compression from a normal rate of 175 words per minute.

The acceleration of records and tape recordings produced accelerated speech, but the result was a decrease in intelligibility because of the change in the speech pitch frequencies. Fletcher reported no appreciable losses in intelligibility occurred until the rate was 1.4 times

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[1]R. G. Nichols. "Ten Components of Effective Listening." Education, 1955, 75, pp. 292-302.

[2]Harvey Fletcher. Speech and Hearing. (New York: Van Nostrand Co., 1929.) pp. 293-294.

the original speech speed.[2]

Goldstein[3] makes no mention of loss of intelligibility; however, his rates never exceeded 322 words per minute. He did point out a decline of reading and listening comprehension with increased rate.

Garvey[4] eliminated two problems when he developed a new method of reducing the length of the original recordings. One, he was able to preserve the normal frequency of the speaking voice and, two, he was able to eliminate the discrepencies encountered when a person was trained to speak at a fixed rate. At standard speeds the tape moves past the recording head at 7.5 inches per second. The words on the tape are extremely close together. In order to space the words out over a longer span of tape, Garvey replaced the standard capstan with a larger one. This allowed the tape to be pulled at 16 inches per second. At this speed the words were spaced out over a longer span making it possible to actually isolate each word and mark its placement on the tape. Garvey was able to cut out alternate sections of tape one centimeter in length, shorten the word by 50 percent and splice the remaining

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[3]H. Goldstein. "Reading and Listening Comprehension at Various Controlled Rates". Teachers College Contributions to Education, 1940, 821. (New York: Bureau of Publications, Columbia University, 1940).

[4]William D. Garvey. "The Intelligibility of Speeded Speech." Journal of Experimental Psychology, 1953, 45, pp. 102-107.

sections back together again. With this technique he was able to eliminate the frequency shift normally encountered when speeded speech was recorded.

Three years before Garvey's "razor blade" technique, Miller and Licklider[5] had accomplished the same result as Garvey with one exception. They did succeed in electronically blanking out part of the speech during the recording using a rotating head. This did, in effect, reduce the length of the audio recording but did not shorten the time necessary to listen to the entire discourse, because the pauses were also recorded on the tape.

In the same year Garvey was working on his splicing method, Fairbanks, Everitt, and Jaeger[6] were perfecting another device to perform electronically what Garvey had done manually. A detailed description of the mechanism and its function can be found in Cramer.[7] Independently, Schliesser[8] had earlier reported perfecting a similar device in Germany. The Fairbanks compressor had some limitations--

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[5]G. A. Miller, J. C. R. Licklider. "The Intelligibility of Interrupted Speech". Journal of the Acoustical Society of America, 1950, 22, pp. 167-173.

[6]G. Fairbanks, W. L. Everitt, R. P. Jaeger. "Method for Time or Frequency Compression-Expansion of Speech". Transactions of the Institute of Radio Engineers, 1954, AU-2, pp. 7-12.

[7]H. L. Cramer. "An Introduction to Speech Time Compression Techniques". Proceedings of the Second Louisville Conference on Rate and/or Frequency-Controlled Speech. Center for Rate-Controlled Recordings, University of Louisville, February, 1971. pp. 6-20.

an annoying tone due to the discard rate (sampling), a limited input and output rate, and a constant maintenance problem with the rotary heads.[9]

Other electronic and computer speech compressing devices are the Harmonic Compressor,[10] the Graham Compressor,[11] and Computer Compressors[12]. An electronic Device perfected by the PKM Corporation has improved the Fairbanks model by not only deleting the pauses between words by integrating a voice actuating circuit to start the tape transport but also by including circuits to selectively delete part of the vowel sound duration. Vowel sounds are highly redundant in language (English) and have a tendency to be somewhat longer in duration than consonnents. Because of this longer duration, 140 to 400 milliseconds, part of the vowel sound may be deleted without reducing the intelligibility appreciably.[13]

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[8]H. Schliesser. "A Device for Time Expansion Used in Sound Recording." Funk Und Ton, 1949, 3.

[9]John W. Breuel and Leo M. Levens. "The A. F. B. Harmonic Compressor." Proceedings of the Second Louisville Conference on Rate and/or Frequency-Controlled Speech. center for Rate-Controlled Recordings, University of Louisville, ebruary, 1971.

[10]John W. Breuel, Leo M. Levens, Ibid.

[11]Wayne W. Graham, Ibid.

[12]S. U. H. Aureshi, Y. J. Kingma, Ibid.

[13]Gordon E. Peterson and Ilse Lehiste. "Duration of Syllable Nuclii in English." Journal of the Acoustical Society of America, 1960, 32, pp. 693-703.

RESEARCH BACKGROUND

In the Goldstein[14] study, adults between the ages of 18 and 65 years were selected to engage in listening to recorded passages at rates of 100, 137, 174, 211, 248, 285 and 322 words per minute. He reported in his findings that:

1. There is a significant decline in reading and listening comprehension with increased word rate,

2. At the faster rates, 211, to 322, the relative difference between reading and listening comprehension becomes smaller, and

3. The more intelligent subjects comprehended more at 322 words per minute than the less intelligent did at 100 words per minute.

The compression was accomplished by training a person to speak consistantly at various controlled rates.

Nelson[15] found essentially the same phenomenon as Goldstein. It was found that listenability decreased as the rate of presentation increased. The passages, selected short stories, were recorded at speech rates of 125, 150, 175 and 200 words per minute. As earlier research indicated, the listenability did decrease but not significantly at these rates. Both Nelson and Harwood[16] found that the listen-

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[14]H. Goldstein, Ibid.

[15]H. E. Nelson. "The Effect of Variation of Rate on the Recall by Radio Listeners of 'Straight' Newscasts." Speech Monographs, 1948, 15, 172-180.

ability of difficult material at accelerated rates, 200 words per minute, was significantly decreased.

The research of Garvey as mentioned earlier, was extremely important to the concept of speech compression without pitch distortion. Garvey saw great potential in research conducted by John Black[17] in which he was studying word intelligibility. Black was studying the intelligibility by determining the significance of phonemes. He was removing part of the words by cutting the tape with a razor blade. This removal affected the intelligibility but, in effect, produced the first compressed speech tape without frequency distortion.

Garvey, using some of the same "cut and splice" techniques, found that at accelerations as high as 2.5 times the original speed, the intelligibility decreased only about 10 percent. A significant finding was that acceleration of the recording resulting in a frequency shift (Donald Duck Effect) had more of a detrimental effect upon the intelligibility than removal of portions of the speech pattern by cutting the tape.

There is a discussion concerning the rate of normal speech. Fairbanks, Guttman, and Miron[18] used a normal speed target rate of 140 words per minute. Orr,

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[16]K. A. Harwood. "Listenability and Rate of Presentation." Speech Monographs, 1955, 22, pp. 57-59.

[17]John Black. Cited by H. Leslie Cramer, op. cit., pp. 6-20.

Friedman and Williams,[19] Orr and Friedman,[20] Orr, Friedman and Graae,[21] George,[22] Rossiter,[23] and Grumpelt and Rubin[24] report that normal speech is approximately 175 words per minute. Sticht[25] used 158 words per minute in one experiment and 100 words per minute in a second experiment. Sticht[26] in a study utilizing the time saved to increase learning, used 178 words per minute as the normal rate.

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[18]G. Fairbanks, N. Guttman, M. S. Miron. "The Effects of Time Compression Upon the Comprehension of Connected Speech." Journal of Speech and Hearing Disorders, 1957, 22, pp. 10-19.

[19]D. B. Orr, H. L. Friedman, and J. C. C. Williams. "Trainability of Listening Comprehension of Speeded Discourse." Journal of Educational Psychology, 1965, 56, pp. 148-156.

[20]D. B. Orr, H. L. Friedman. "Effects of Massed Practice on the Comprehension of Time-Compressed Speech." Journal of Educational Psychology, 1968, 59, pp. 6-11.

[21]D. B. Orr, H. L. Friedman, and C. N. Graae. "Self Pacing Behavior in the Use of Time-Compressed Speech." Journal of Educational Psychology, 1969, 60, pp. 28-31.

[22]R. G. George. "Retention of Prose Material as a Function of Rate of Presentation and Difficulty of Material." A V Communications Review, Fall 1970, 18, pp. 291-300.

[23]C. M. Rossiter. "Rate of Presentation Effects on Recall of Facts and of Ideas on Generation of Inferences." A V Communications Review, Fall 1971, 19, pp. 313-323.

[24]H. R. Grumpelt, E. Rubin. "Speed Listening Skill by the Blind as a Function of Training." Journal of Educational Research, 1972, 65, pp. 467-471.

[25]Thomas G. Sticht. "Some Interactions of Speech Rate, Signal Distortion, and Certain Linguistic Factors in Listening Comprehension." A V Communications Review, Summer 1969, 17, pp. 159-171.

Foulke and Sticht[27] discuss the problem of assignment of a rate to be designated as "normal":

> "The final word rates of two listening selections, compressed or accelerated by the same amount, depend upon the rates of speaking before compression."

The rate reported for normal speech is varied to such an extent that the term "normal" must be well defined. Foulke and Sticht also warn that it is " . . . advisable to describe compressed speech not only in terms of the amount of compression but also in terms of word rate."

Effective listening is a very important part in the comprehension of material. Poor listeners are inexperienced in hearing difficult expository material and often avoid material of higher academic level. Nichols[28] provides ten components of effective listening:

1. Previous experience with difficult material
2. Interest in the topic at hand
3. Adjustment to the speaker
4. Energy expenditure of the listener
5. Adjustment to the abnormal listening situation

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[26]T. G. Sticht. "Failure to Increase Learning Using the Time Saved by the Time Compression of Speech". Journal of Educational Psychology, 1971, 62, pp. 55-59.

[27]Emerson Foulke, and Thomas G. Sticht. "Review of Research on the Intelligibility and Comprehension of Accelerated Speech". Psychological Bulletin, 1969, 72, pp. 50-62.

[28]Nichols, op. cit.

6. Adjustment to Emotion-laden words
7. Adjustment to Emotion rousing points
8. Recognition of central ideas
9. Utilization of notes
10. Reconciliation of thought speed and speech speed

Nichols estimates that a person can assimilate approximately 400 words per minute and states that most conversation discourse takes place at approximately 125 words per minute. He has generalized that:

> "The core of the problem of effective listening is the development of the utmost possible concentration in the immediate listening situation. Concentration by the learner, however, is inseparably inter-twined with two variables largely beyond his control; his own speed of thought and the rate of speech of the communicator."

Some very early research by Jersild[29] indicated that repetition of material is most effective (comprehension scores are higher) if successive (three or more) presentations are separated by intervals of time. In a heirarchy effectiveness criteria, he places the " . . . device of speaking very slowly at the bottom of the list, in fact, 'speaking slowly' has a decided negative effect."

Goldstein[30] found that two fast presentations may

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[29]Arthur Jersild. "Modes of Emphasis in Public Speaking." Journal of Applied Psychology, 1928, 12, pp. 611-620

[30]Goldstein, op. cit.

be superior to one slow presentation within the same time limits. Studies by Good[31] and Coulter[32] indicated that not much is gained in the second presentation. Voor[33], in opposition, rejected his hypothesis that successive trials or listening to very rapid speech will not result in significant improvement in comprehension scores. This study supports ideas that practice in listening may improve comprehension. Further, he states that the practice period needed to preceed the learning activity need not be very long. His findings supported that the "adaptation" required only 7 minutes of listening time or exposure to 2,700 words of time compressed speech.

A determination of the effect of listening to time compressed messages twice within the time period required to listen to normal rate messages once was studied by Sticht.[34] The results indicated that the comprehension scores were better if the subject listened to two time-compressed

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[31]C. V. Good. "The Effect of a Single Reading Versus Two Readings of a Given Body of Material." Journal of Education Method, 1926, 5, pp. 325-329.

[32]M. A. Coulter. "Comprehension and Retention in Reading Through Repetitions." University of Pittsburgh School of Education Journal, 1930, 6, pp. 63-70.

[33]J. B. Voor. "Effect of Practice Upon the Comprehension of Time Compressed Speech." Speech Monographs, 1965, 32, pp. 452-454.

[34]Thomas G. Sticht. "Some Interactions of Speech Rate, Signal Distortion, and Certain Linguistic Factors in Listening Comprehension." A V Communications Review, Summer 1969, 17, pp. 159-171.

messages, but he also found there was not a significant difference in the comprehension scores over listening to the normal speech message once.

In a later study, Sticht[35] interpreted the research findings to be inadequate to support the hypothesis that using the extra time resulting from the time compression of materials, to repeat the information would improve learning over listening to it once at the normal rate. In fact, he concurs with Fairbanks, Guttman, and Miron that listening to the uncompressed material twice may not significantly increase comprehension although it does increase. The study by Sticht was designed to test the hypothesis that if new information was presented during the time saved perhaps an increase would occur in the overall comprehension. This study was conducted with army inductees. Compression of a six-minute four-second passage at 36 percent (278 words per minute) and 53 percent (378 words per minute) provided the material for the initial presentation. Two additional tapes were produced at the same compression rates that provided additional information. The differences found were not significant at $p < .05$ between the compressed speech plus additional compressed information and the normal speech presentation.

Parker[36] reports in a study using Junior College

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[35]Sticht, 1971, op. cit., pp. 55-59

Students that comprehension improved when a printed script was provided while they listened to speech compressed approximately 35 percent. Further, he found no significant loss of comprehension overall due to accelerated speech, however, there was a significant difference between the means of low and high aptitude students.

A finding by Challis[37] concerning the achievement of low grade point students was that they seemed to have greater achievement when compared to the achievement of high grade point students when they were allowed to select their own compression rate. This phenomenon may indicate that the low achiever is stimulated by the compressed speech and may have helped to develop the different study style needed in order to improve academic performance. On the other hand, the high achiever has been successful under the previous normal rate presentations and may be reluctant to change. The student has developed a successful study style and therefore may not be so stimulated by the compressed speech. There are indications, however, that the comprehension level of subjects with average general achievement is not significantly impaired by compressed speech at moderate rates.

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[36]C. C. Parker. "Effect of Rate of Compression and Mode of Presentation on the Comprehension of a Recorded Communication to Junior College Students of Varying Aptitudes." Proceedings of the Second Louisville Conference on Rate and/or Frequency-Controlled Speech. Louisville: University of Louisville, 1971.

Foulke and Sticht[38] measured the effects of accelerated rates on both comprehension and intelligibility and found that the intelligibility declined at a lesser rate than comprehension, however, both did decrease with increasing word rate and was insignificant up to approximately 325 words per minute. Thereafter, the comprehension declined rapidly also.

The effect of practice on comprehension was extensively studied by Orr, Friedman and Williams[39] and Orr and Friedman[40]. In the first study at 425 words per minute, the experimental group had better than 75 percent comprehension while the control group did not quite achieve the 50 percent level. Another significant factor was that even without practice the control group performance fell only 20 percent at the 425 word per minute level. In the second study, male subjects between the ages of 19 and 20 (freshman or sophomore college level) listened to twelve novels played at 425 words per minute. Brief rest periods

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[37]A. James Challis, "The Effect of Fixed and Learner Selected Rates of Compressed Speech in an Audio-Tutorial Learning Environment on the Achievement of College Level Students." Unpublished Doctoral Dissertation, University of Oklahoma, Norman, Oklahoma, 1973.

[38]E. Foulke, T. Sticht. "The Intelligibility and Comprehension of Time-Compressed Speech." Proceedings of the Louisville Conference on Time-Compressed Speech. Louisville: University of Louisville, 1967.

[39]Orr, Friedman and Williams, 1965, op. cit., 148-156.

[40]Orr, Friedman, 1968, op. cit., 6-11.

were given between successive listening session. The practice period lasted for 5 days from 9 a.m. until 9 p.m. No lesson lasted for more than 48 minutes between which quizzes were given. The schedule was close-packed and extensive. The participants were paid $100 plus bonuses if they showed great proficiency on the quizzes. The results again supported previous results. Comprehension of time-compressed speech can be improved by simple practice routines to relatively high levels at speeds of approximately 2.5 times normal.

Other studies supporting the practice effect are Thames and Rossiter[41] and Grumpelt and Rubin[42]. Foulke[43] found that practice did not have a positive effect on comprehension when applied to blind persons.

It can be generalized from the preceeding research that training subjects to listen to time-compressed speech can raise the comprehension level. Further research needs to be done to substantiate just how much the level is raised and if it is significant.

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[41]K. H. Thames, C. M. Rossiter, Jr. "The Effect of Reading Practice with Compressed Speech on Reading Rate and Listening Comprehension." A V Communications Review, Spring 1972, 20, pp. 35-41.

[42]H. R. Grumpelt, E. Rubin. "Speed Listening Skill by the Blind as a Function of Training." Journal of Educational Research, 1972, 65, pp. 467-471.

[43]E. Foulke. "The Comprehension of Rapid Speech by the Blind--Part II." Final Progress Report, Cooperative Research Project No. 1370. Office of Education, U. S. Department of Health, Education and Welfare, Washington, D. C., 1964.

The intelligibility of compressed speech can be substantiated by research done by Fletcher[44], Garvey,[45] Miller and Licklider[46] and Sticht.[47]

The experimentation by Sticht indicates that signal distortion affects listening comprehension.[48] This experimentation was somewhat more sophisticated than previous research with intelligibility. Sticht recorded a compressed 40 percent version of a passage related to a military activity. This 40 percent version was then expanded to produce a word rate equivalent to the normal version. The expanded recording then had the same signal distortions as the compressed version. The control group had the normal version, the experimental groups had the 40 percent expanded to normal versions. The results that were significant are:

1. There was a significant drop in comprehension due to the 40 percent compression (M 25.33 to m 18.10)

2. Interestingly enough, when the 40 percent version was expanded the difference in comprehension from the normal version was not significant even with the distortion. (M 25.33 to M 24.44).

The results are consistant with previous results of

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[44]Fletcher, 1929, op. cit.

[45]Garvey, 1953, op. cit.

[46]Miller and Licklider, 1950, op. cit.

[47]Sticht, 1969, op. cit.

[48]Ibid.

Foulke and Sticht who found that the decline in comprehension is mostly due to the fast rate of presentation rather than signal distortion.[49]

Thames and Rossiter[50] in a study using high school students looked at compressed speech as a pacer in the improvement of reading rates. Their conclusions showed "reading practice with accompanying compressed speech as a pacer resulted in a significantly greater increase in reading rate without an accompanying loss in comprehension . . . ". The use of compressed speech as a forced-pacer is the auditory counterpart of the visual mechanical devices such as the tachistoscope, flash meter, pacer, and controlled reader. Brim[51], Cosper and Kephart,[52] and Dumler[53] report that the mechanical devices do seem to improve the reading rates of subjects who practice using the forced-pacing methods. However, Harris[54] warns that there may be a problem

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[50]K. H. Thames, C. M. Rossiter, Jr. "The Effects of Reading Practice with Compressed Speech on Reading Rate and Listening Comprehension." A V Communications Review, Spring 1972, 20, 35-42.

[51]B. J. Brim. "Impact of a Reading Improvement Program." Journal of Educational Research, 1968, 62, 177-181.

[52]R. Cosper, N. C. Kephart. "Retention of Reading Skills." Journal of Educational Research, 1955, 49, 2211-2216.

[53]M. J. Dumler. "Study of Factors Related to Gains in the Reading Rate of College Students Trained With Tachistoscopes and Accelerator." Journal of Educational Research, 1958, 52, 27-30.

[54]A. J. Harris, E. R. Sipay. Effective Teaching of Reading. (New York: David McKay, Inc., 1971.) p 220-221.

substantiating that once the subject is trained to read rapidly he may not continue to do so when not using the pacer.

Although George[55] did not specifically designate his procedure as forced-pacing or controlled delivery, his procedure turned out to support this phenomenon. In the study involving retention of prose material conducted with college freshmen, he states after he had played recorded instructions the "plans had been made to answer questions by replaying the taped instructions; however, there were no questions." He then played a recorded selection of prose material one time to the students and gave them an objective test immediately following. They were asked to return later and take the test again. In addition to the finding that more forgetting occurred at the lowest rate of presentation than at higher rates, another point to be strongly noted is that the subjects were in effect forced-paced and heard the material only one time and yet the comprehension loss was rather insignificant.

Rossiter[56] also controlled the delivery of information, forced-paced, to undergraduates. He did not state

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[55]R. G. George. "Retention of Prose Material as a Function of Rate of Presentation and Difficulty of Material." A V Communications Review, Fall 1970, 18, 291-299.

[56]C. M. Rossiter. "Rate of Presentation Effects on Recall of Facts and of Ideas and on Generation of Inferences." A V Communications Review, Fall 1971, 19, 313-324.

the recordings were played more than one time yet no mention was made that the students had the opportunity to "re-listen" if they needed to.

The same procedure was used by Foulke[57] when he presented recorded (and compressed at various rates) passages to college students. His results showed that the comprehension at word rates up to 250 were relatively unaffected but after 250 the comprehension declines rapidly. This study in effect was a forced-paced study. The results may be, and most likely would be, different if the recordings had been available to students so they could have listened to the information more than one time.

Peters[58] found that note-taking during normal and accelerated rates of presentation did in fact have a harmful effect on the comprehension. He too, used taped passages and the students were informed that ". . . the study was concerned with their performance on a series of listening tasks, that they would have to listen carefully, and that they would be tested on the material." No mention was made that students could replay the information at any time before being evaluated.

In a study to test the effectiveness of taped

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[57]E. Foulke. "Listening Comprehension as a Function of Word Rate." The Journal of Communication, 1968, 18, pp. 198-206.

[58]D. L. Peters. "Effects of Note Taking and Rate of Presentation on Short-Term Objective Test Performance." Journal of Educational Psychology, 1972, 63, pp. 276-280.

reading instruction and improvement of reading rate, Bryant[59] found that in under-educated adults the reading rates and comprehension levels are increased by using recordings. Bryant did specifically mention the subjects were not allowed to re-read or re-listen to the taped material a second time.

The previously mentioned research supports the concept that forced-pacing students through material or controlling the delivery of the material does not decrease the comprehension levels significantly, in fact, in most cases the comprehension is at least comparable. But, since none of the above research was specifically designed to test the effects of forced-pacing or controlled delivery, it follows that more research is needed in this area.

SUMMARY

The foregoing discussion of the current research reveals a great deal of activity involving the use of compressed speech for educational purposes. There are, of course, many other studies similar in nature with similar results.

Indications from the literature reveal a variety of

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[59]A. S. Bryant. "The Effectiveness of Taped Reading Instruction in Increasing the Reading Rate and Comprehension of Undereducated Adults." Adult Education Journal, 1971, 21, pp. 246-252.

uses of time-compressed speech. In addition to a limited use of automated study programs in the classroom, compressed speech methods are applied to training programs, lectures, communication transmittal, reading practice, listening and training programs for the blind, and reading pacing programs. An interesting application may be in the training of flight instructors and air controllers. Compressed speech may be useful for this purpose since a great deal of the working procedure is involved with rapid audio instructions and audio communications, much of which would be repeated rapidly, one time, for immediate action. The findings of this study, for example, may be of interest to those doing research in that area since forced-pacing of information is naturally common in situations involving rapid communications.

Compressed speech is useful in programmed study and tutorial programs where the main media form is the audio recording. Moderate compression rates of 30 to 35 percent enable reduction of the listening time approximately one-third the original duration without significant loss in comprehension. In fact, it is documented by Orr, Friedman and Graae[60] that some speeding is preferred by subjects when they are allowed to choose their listening speeds.

This research supports, however, the need for further

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[60]D. B. Orr, H. L. Friedman, C. N. Graae. "Self Pacing Behavior in the Use of Time-Compressed Speech." Journal of Educational Psychology, 1969, 60, pp. 28-31.

study in the practical application of the methods and materials cited. The use of compressed speech techniques is a time saver, allowing students to best utilize their extra time in educational activities. It should be noted that in many of the studies the compressed material was limited to small passages or even to unconnected word lists.

The research points out very strongly that at extreme rates the comprehension drops, but at speeds up to double the normal speaking rate (approximately 250 to 300 wpm) the intelligibility and comprehension do not significantly decline. It is well documented too, that training (repetition) does in most cases assist in keeping the comprehension level up even at the higher accelerated rates.

Extensive intelligibility and comprehension studies have been made with both single word and word passages. Foulke,[61] Bixler,[62] Friedman and Orr,[63] Heise,[64] and Foulke

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[61]E. Foulke. "Listening Comprehension as a Function of Word Rate." Journal of Communication, 1968, 18, 198-206.

[62]R. H. Bixler, E. Foulke, C. Amster, and C. Nolan. "Comprehension of Rapid Speech by the Blind, Part I." (Cooperative Research Project No. 1005, Washington, D. C.: United States Department of Health, Education, and Welfare, Office of Education, 1961.)

[63]H. L. Friedman, D. B. Orr. "Research on Speeded Speech as an Educational Medium. Project Report." (Washington, D. C.: American Institute for Research, 1966).

[64]R. Heise. "The Intelligibility of Compressed Words." Proceedings of the 2nd Louisville Conference on Rate Controlled and/or Frequency-Controlled Speech. Center for Rate-Controlled Recordings (Louisville: University of Louisville, Feb., 1971.)

and Sticht[65] have reported that intelligibility is generally preserved at speech rates up to approximately 350 words per minute. Generally it is said that when the speech rate exceeds double the normal rate, comprehension begins to decline rapidly. The intelligibility and comprehension levels depend, in part, upon the methods of compression and the experience of the listener as well as the difficulty of the material.

Foulke reports that the research shows comparison ranges in which the comprehension losses become significant.[66]

TABLE 1. WORDS PER MINUTE RANGE AND COMPREHENSION LOSS

Range Words Per Minute	Result	% Decline	Experimenter
126-172	unaffected	-	Diehl, White & Burk
125-225	insignificant	-	Nelson & Harwood
141-201-282	small difference	-	Fairbanks, Guttman, Miron
282		42	"
470		74	"
up to 275	slightly affected		Foulke, Amster, Nolan and Bixler
275-375	accelerated decrease		"
225-325	slight decrease	6	Foulke and Sticht
325-425		14	"

[65]E. Foulke, T. G. Sticht. "Review of Research on the Intelligibility and Comprehension of Accelerated Speech." Psychological Bulletin, 1969, 72, 50-62.

It can be generalized from this and other research that the findings are very well in agreement supporting a rapid decline above 300 words per minute. At higher accelerations, the slope of the intelligibility and comprehension curve is more acute.

Rates above 300 or 350 words per minute seem to be difficult for a subject to comprehend. Naive subjects, those who have never been exposed to compressed speech, would especially experience some difficulty at the higher rates at the initial presentation.

According to Grumpelt and Rubin:[67]

> "Conflicting results have recently been reported regarding whether practice can substantially increase the level of comprehension of time compressed speech."

Foulke found no effects of practice in a study with blind children[68] and Orr and Friedman[69] found some positive results with practice involving prose material with college students.

In the case of learning versus repetition, Sticht[70-71]

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[66]E. Foulke, op. cit., 198-206.

[67]H. R. Grumpelt, and E. Rubin. "Speed Listening Skill by the Blind as a Function of Training." Journal of Educational Research, 1972, 65, 467-471.

[68]E. Foulke. "The Comprehension of Rapid Speech by The Blind--Part II." Final Progress Report, Cooperative Research Project No. 1370. Office of Education, U. S. Department of Health, Education and Welfare, Washington, D. C., 1964.

[69]D. B. Orr, H. L. Friedman. "Effect of Massed Practice on the Comprehension of Time-Compressed Speech." Journal of Educational Psychology, 1968, 59, 6-11.

reports in a study designed to test for increases in comprehension based on the addition of new material during the time saved by compressing the original material, that listening to additional information in that period may not lead to increased learning. An earlier study by Sticht provided data to support that listening to compressed data twice did not significantly improve comprehension of a subject over a subject listening to the same material once at the normal rate.

The research suggests that at a lower accelerated rate the intelligibility and comprehension does not significantly decline and that successive passes of the information under study does not significantly raise the learning level. Training apparently does enable a subject to raise the comprehension level of compressed information.

A distinction in the deviation of the design of this study from those cited in the review is that the training in the previous research was in listening to compressed speech passages for the express purpose of training while in this study the training is limited to a 5 minute pre-program compressed speech sampler. The main training

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[70] T. G. Sticht. "Failure to Increase Learning Using the Time Saved by the Time Compression of Speech." Journal of Educational Psychology, 1971, 62, 55-59.

[71] T. G. Sticht. "Comprehension of Repeated Time Compressed Recordings." Journal of Experimental Education, 1969, 37, 60-62.

actually comes through exposure to the compressed audio program with the emphasis on the material content rather than expertise in listening to compressed speech.

A second distinction is that previous research allowed students to review the accelerated material more than one time, if they chose to, before they were evaluated for comprehension. This resulted in defeating the time saved. In this study the students did not have the opportunity to listen but one time in one group and listened as many times as they wished in another group. The results of the evaluation provide indications of the necessity of repeated passes to maintain the comprehension levels versus maintenance of shortened learning periods.

A third distinction is that the accelerated rate is fixed at approximately 30 percent of normal rather than allowing the student to select the compression rate. This low rate is at the threshold of both the pause deletion sampling method and the established word rate comprehension decline resulting in practically no signal distortion as well as being slow enough not to "run away" and fast enough to challenge the student.

CHAPTER III

PROCEDURES IN RESEARCH DESIGN

SUBJECTS

The subjects used in this study were students enrolled for the Fall term, 1973 in the 4001 Competency in Instructional Media course, The Division of Teacher Education and Psychology, Southwestern State College, Weatherford, Oklahoma. The subjects were students already admitted to teacher education. Grade point averages ranged from 2.02 to 3.95. Some of the students had completed all coursework with the exception of the professional semester and student teaching. Others were sophomores and juniors. The ages were primarily from 20 to 22 years old. The students generally reside in western Oklahoma rural communities. Some had their initial college work from a junior college in western and central Oklahoma.

In addition to having an established grade point average, these students had previously taken the School-College Aptitude Test (SCAT) which is a required prerequisite for admission to teacher education. There were more female students than male students. The ratio was 49 females to 33 males.

PROCEDURE

Overall Plan for the Study

The students enrolled in Education 4001, Competency in Instructional Media were randomly assigned to four groups:

GROUP	PROGRAM	PACING
I	30 Percent Compressed	Forced
II	Normal Rate	Forced
III	30 Percent Compressed	Self
IV	Normal Rate	Self

An established automated program authored by W. R. Fulton, et. al., at the University of Oklahoma, now available commercially, was administered as the main program. The audio portion is supplied on audio cassette and supplemented with a set of color filmstrips. For this study both the filmstrip and the audio portion were transcribed to 3/4 inch video tape cassette.

A posttest was administered following the last lesson in the program.

Specific Procedures Within the Research Plan

Assignment. Random assignment of students to four groups was accomplished with the aid of a table of random numbers. The two classes, the 9 a.m. and the 11 a.m. hours were treated as one population and were approximately the same size due to scheduling. Four groups of 21 were selected

from this population and the excess students were divided into two other classes not used in this study.

Because of sectioning by the administration and student freedom to enroll in any course at any hour, it was not possible to randomly select students from the entire student body of teacher education to take part in this study. It was necessary to randomly assign as outlined above.

The assignment of students from both the 9 a.m. and the 11 a.m. hours into four groups is substantiated by the following discussion.[1]

> "Sometimes a researcher cannot hold conditions constant in the experiment; consequently, he resorts to techniques of balancing out, randomizing out, or counterbalancing unwanted variables that may affect dependent variable scores. To equalize or balance out the effect of differences in the abilities of teachers or the sensitivity of apparatus, an experimenter may randomly assign half of the experimental subjects to each teacher and to each piece of apparatus . . . . The differences in subjects, teachers, and apparatus will affect the dependent variable scores, of course, but they will affect the scores of both groups. Consequently, the investigator can assume that the experimental findings are produced by the independent variable and not by these differences in the groups, teachers, or apparatus".

Although the same program was administered to all groups, and the teacher was the same, it was not possible to enroll all students in the same time period. One reason was that the facility in which the classes met was not large enough to accomodate all groups at the same time. Another reason was that sections must be offered at more than one time

period in order for students to have the flexibility to compile a workable weekly schedule and another was that the equipment to administer the program was limited. Further, although there may be some variability in the students from 9 a.m. to 11 a.m., it was assumed that the closeness of the hours and the time of day (both morning hours) would not significantly affect the dependent variable. But if it did, the fact that the groups were represented at both hours, counterbalanced that effect.

All subjects received experience in listening to compressed speech by listening to a prepared sampler tape. The duration of the tape was approximately 5 minutes, and the rate of compression was 30 percent.

Pretest Elimination. Since one of the purposes of the study was to investigate the relative achievement of the experimental group as compared to the achievement of the control group, and not the individual achievement of a group member, and because of the random assignment of the subjects, the pretest was deemed unnecessary. Campbell and Stanley[2] state that although the pretest-posttest design is very popular with researchers in education and psychology, it is not essential to true experimental designs. "Random-

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[1]Deobold B. Van Dalen. Understanding Educational Research. (New York: McGraw-Hill Book Co., 1973) p 265.

[2]D. T. Campbell, J. C. Stanley. Experimental and Quasi-Experimental Designs for Research. (Chicago: Rand McNally and Company, 1963.) p 25.

ization can suffice without the pretest." Additionally, the availability of the School-College Aptitude Test Scores and the grade point average (GPA) provide indications for the equivalency of the groups.

Posttest. The posttest was developed by the University of Oklahoma, Norman, Oklahoma. It was administered by the experimenter immediately following the last administration of the programmed unit. No attempt was made to add to the questions of the test, however, the questions were rearranged and where clarification was needed, corrections were made. The Mid-term and the Final Examination are included in Appendix F.

Test Validity and Reliability. No attempt was made to adjust the content of the posttest. The content validity of the posttest has been extablished at the University of Oklahoma and the judgement was made that the content of the test measures the content of the automated course. The posttest had been used and judged reliable by successive administrations by other researchers,[3-4-5] however a split-half test reliability coefficient was calculated to verify the coefficient using another method. The calculation is

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[3]Challis, op. cit., p 36. The Mid-term and Final Examination administered by Challis were very similar to the tests administered in this study. Some items were rewritten for clarification only. (Mid-term r = .88; Final Examination Form A r = .73 and Form B r = .74.)

shown in Chapter IV. The test has been administered repeatedly with consistant results to students engaged in meeting media competency requirements in teacher education at the University of Oklahoma.

Test Tape. A preliminary test tape, audio only, was produced in 30 percent compressed form. The audio intensity was identical to the taped lessons presented thereafter. This tape provided an opportunity for the students to adjust their headset volume to a comfortable level as well as become accustomed to the feel of the headsets. The tape was approximately 30 seconds in length. A transcript of the tape is given below:

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[4]Jordan, Dan. "The Effects of Integrating Discussion Sessions with a Self-Instructional Course in Audio-Visual Methods," Un-Published Doctoral Dissertation, The University of Oklahoma, 1972. The Kuder-Richardson Formula 20 was used to find the test reliability of .81. The test used in the Jordan study was 140 items. The test administered in this study was not identical in length but the test questions were drawn from the test used by Jordan, p 30.

[5]Paschall, Jack W. "The Comparative Effectiveness of Two Instructional Systems for Teaching The Course 'Audio Visual Materials in Teaching' ". Un-Published Doctoral Dissertation, The University of Oklahoma, 1970. The Kuder-Richardson Formula 21 was used to find the test reliability. The reliability coefficient was not given in the study, however, Paschall stated "The results of this computation indicated that the instrucments already had an acceptable level of reliability." Paschall gave three examinations. Although the tests were not identical to the tests given in this study, the items on the tests given in this study also appeared on the tests given by Paschall. p 32.

"The volume of this tape is recorded at the same level as the information contained by the lesson you are about to hear. If the volume is too high, you may adjust to a lower level by turning the dial on the terminal in front of you. If you turn it to the left, the volume will decrease. If you turn it to the right, the volume will increase. Make sure the headsets are comfortable by adjusting the head band.

(Pause 10 seconds)

If there are any questions about the equiment or if you are having difficulty, raise your hand and the instructor will assist you before we begin the lesson."

Compressed Speech Familarization. A passage of approximately 800 words was selected and compressed at the 30 percent rate. This passage was approximately five minutes in length and served as a brief training session to familiarize the student with compressed speech. The passage was randomly selected from the Automated Program, Unit 12. (See Appendix C.)

Program Administration. The automated course, filmstrip-sound, developed by W. R. Fulton, et. al., University of Oklahoma with the accompanying manual, Student's Guide to the Study of Educational Media: An Automated Course was used as the experimental teaching method. Modifications of the filmstrip-sound program included:

1. Transcription of the audio track to television tape (3/4 inch cassette)

Program 1 - Normal Speech Rate

Program 2 - 30% Compressed Speech

2. Transcription of the video portion (filmstrip) to television tape.

Programs 1 and 2 were identical to the slide tape program with the exception of some added pauses for clarification.

The students were scheduled by groups to watch the video portion and listened through headsets to the audio portion. (See Appendix A for the unit administration schedule). Upon completion of the preliminary test tape, and a brief pause for final adjustments, the video taped lesson was activated. Upon completion of one pass of the video tape, the students left the facility and independently completed the self-test contained in the accompanying manual. The entire program, 16 lessons, was administered in this manner.

Equipment. The Variable Speech Control Copycorder, Model CC-103 available from the Magnetic Video Corporation, was used to accomplish the compression of the audio material. The Copycorder is equipped with a VSC integrated circuitry module which compresses the speech by systematic sampling. Many small samples are extracted from the recorded material each second and then individually restored in pitch and electronically linked together.

The television tape recorder/player was manufactured by Sony Corporation. The model used was VCR 1600, 3/4 inch video cassette. The television monitor was a 23 inch

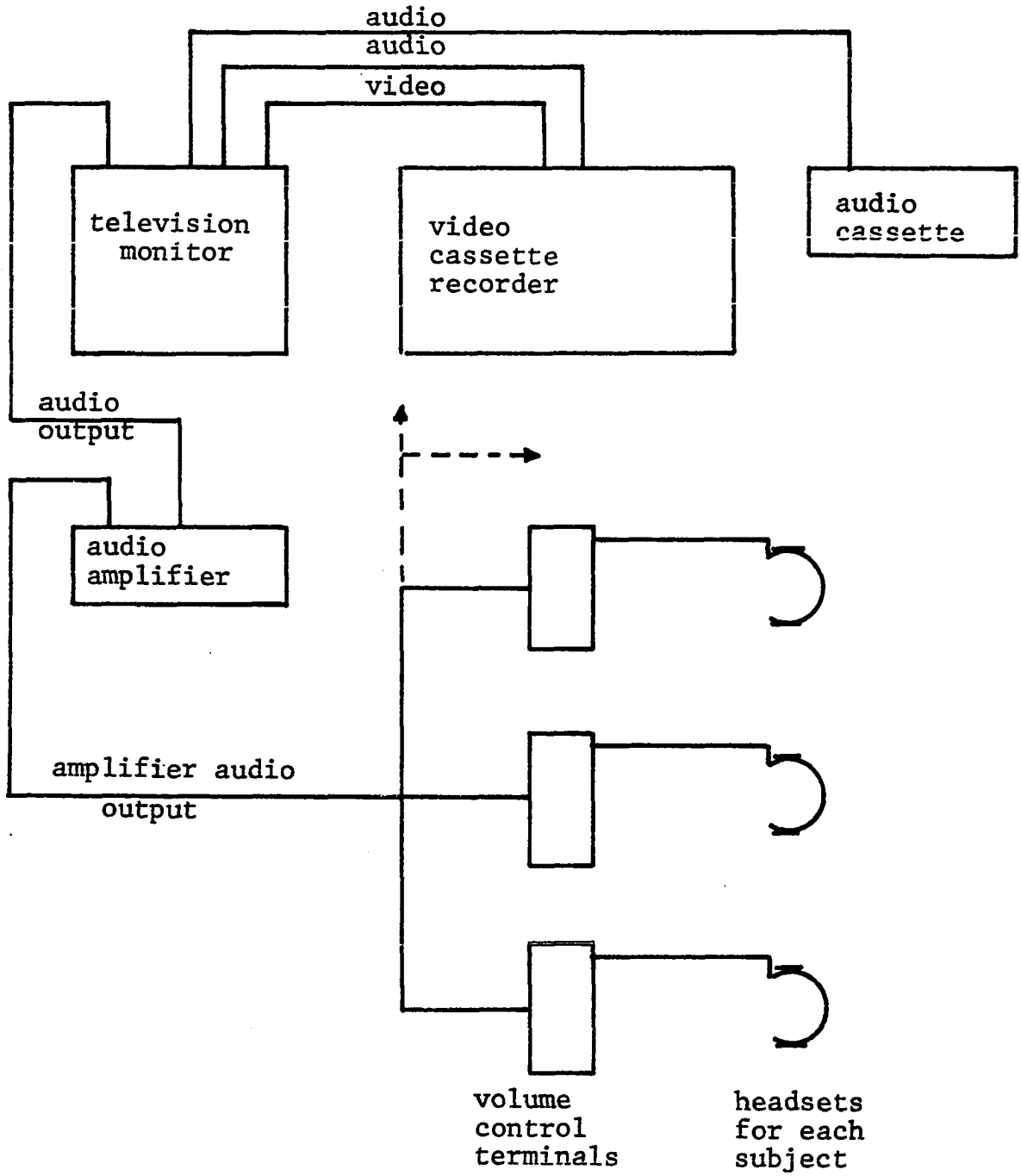

Fig. 1. Diagram of the Research Apparatus

black and white Magnavox television receiver/monitor.

The audio amplifier was a Realistic Public address amplifier, solid state, model no. MPA-20, 20 watt.

Summary of Specific Procedures. The following table and procedure was the guide used to administer the program.

1. Enrollment and random assignment
2. First Week - Orientation and Testing
   Administration of the Nelson-Denny Reading Test
   Compressed Speech Listening Package
3. Program Administration

   Second Week - Units I, II

   Third Week - Units III, IV

   Fourth Week - Units V, VIa, VIb, VIc

   Fifth Week - Units VId, VII, VIII

   Sixth Week - Units IX, X, XI

   Seventh Week - Units XII, XIII
4. Final Examination

Selection of Compression Rate. A compression rate of 30 percent was selected for this study, based on the work of Orr, Friedman and Graae[6] and Challis.[7] Orr, Friedman

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[6]D. B. Orr, H. L. Friedman, and Cynthis N. Graae, "Self-Pacing Behabior in the Use of Time-Compressed Speech". Journal of Educational Psychology, 1969, 60, 28-31.

[7]Challis, op. cit.

and Graae found that when the subjects were allowed to select their own rate, they all preferred some compression. No student selected lower than 1.16 times the normal word rate. Based on the normal rate of 175 words per minute, the rate would be approximately 203 words per minute. This is approximately 20 percent compression rate. Challis found that when he tabulated the compression rates for subjects in the group who were allowed to select their own compression rates, 79 percent had chosen the 20 percent rate. However, in his questionnaire he found that 71 percent of the students had stated they preferred 30 percent compression or higher. The normal rate for this study was approximately 150 words per minute average which would lower the compression rate when compared to Orr, Friedman, and Graae.

Because the students tend to prefer compressed material and because it is known they will at least select a rate near 20 percent when they are allowed to freely select, and because the previous research substantiates this rate, a compression of 30 percent was the target rate. This compression did not duplicate the preferred rate but added to the challenge of the material without over-taxing the student by accelerating the speech beyond his capacity to receive information. The 30 percent compressed program was found to be an average of 211.08 words per minute.

Computation of the compression rate used in this

study can be found in Appendix B.

Readability-Listenability. There may exist a parallel between listenability and readability. Klare writes:

> "If the writer's material is to be presented orally and he is concerned for its comprehension, more readable material again may or may not provide an increase (in comprehension)."[8]

Klare also states that one of the problems in equating the two is the mere opportunity for a reader to go back and scan over the material and re-read it, while it is most of the time impossible to re-listen to messages spoken orally. Audio tape in one-to-one communication may be an exception.

The Flesch Readability Formula[9] was applied and interpreted to assess the level of readability of the audio script. For interpretation of scores see Table 1 in Appendix C.

R. E. = 206.835 - .846 wl - 1.015 sl

where wl = number of syllables per 100 words

sl = the average number of words per sentence

R.E. = Reading Ease

The readability of the automated media program material was found to be 40.235 and was interpreted to be written at the "academic" level.

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[8]G. R. Klare. The Measurement of Readability. (Ames, Iowa: Iowa State University Press, 1963.)

[9]R. Flesch. How to Test Readability. (New York: Harper and Row, 1951).

Comparison of Program Material with Television News Broadcasts. Two television news broadcasts, one aired on December 31, 1973, narrated by Roger Mudd and one on January 11, 1974 narrated by Walter Cronkite were recorded and transcribed to a script. The script was used to calculate the word rate per minute of a well known news commentator heard repeatedly via television. The partial scripts are included in appendix D. The calculation was made to see how a normal television script speed compared to the normal speed of the prepared television media program used in the study. Table 2 presents the word rates of the two broadcast television news programs as compared to the word rates of the normal and compressed media programs. The mean word rate of 175.50 words per minute is very close to the 175 words per minute considered normal by most researchers in compressed speech.[10]

Description of the Facility. The classroom area was of sufficient size to comfortably seat the groups. The north side of the room was equipped with a black curtain which was partially closed during the administration of the program. This darkened the room slightly. It was necessary to have enough illumination so the students could take notes if they wished. The room had two doors. Since all students

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[10]Emerson Foulke, and Thomas G. Sticht. "Review of Research on the Intelligibility and Comprehension of Accelerated Speech." Psychological Bulletin, 1969, 72, 50-62.

TABLE 2 - COMPARISONS OF BROADCAST TELEVISION NEWS COMMENTATORS WORD RATES

Commentator	Words	Time/Min	WPM
Eric Sevareid	450	2.68	167.91
Roger Mudd	244	1.30	187.69
Tom Fenton	378	2.23	178.47
Walter Cronkite	304	1.81	167.95
Mean Words Per Minute			175.50
Compressed Rate Media Program	724	3.43	211.08
Normal Rate Media Program	724	4.83	149.90

were engaged in watching and listening to the program at the same time, no disturbance was permitted by students leaving or arriving once the program was started.

Each student had his own headset. The television monitor was a 23 inch black and white model.

The students were seated at a table and were not closer than two screen widths nor farther away than six screen widths. This was approximately a range of three feet to twelve feet.[11] The viewing area was arranged such that no student was outside a 45 degree viewing angle on either side of a perpendicular to the center of the screen.

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[11]C. W. H. Erickson and D. H. Curl. Fundamentals of Teaching with Audio Visual Technology. (New York: The Macmillan Co., 1973.) p 358.

Erickson states that for television viewing, the 6 W rule (six times the screen width) sometimes is stretched to as much as 12 W, however, it was not necessary to alter the rule since the groups were small enough to be placed well within the recommended distances.

RESEARCH DESIGN

To test the hypotheses, the following research designs were selected:

Program: Automated Media Program by W. R. Fulton, et. al.

Tests: Nelson-Denny Reading Test
Final Examination

Independent Variables: Mode of Presentation - Rate of Presentation

A. Mode of Presentation		B. Rate of Presentation	
X_{A1}	Forced-Paced	X_{B1}	30% Compressed
X_{A2}	Self-Paced	X_{B2}	Normal Rate

Dependent Variable: Achievement Scores on Final Examination

Experimental Paradigm: 2 x 2 Factorial Analysis of Variance

$$R\ X_{A1B1}\ O_1$$
$$R\ X_{A1B2}\ O_2$$
$$R\ X_{A2B1}\ O_3$$
$$R\ X_{A2B2}\ O_4$$

Mode of Presentation		Rate of Presentation	
		B_1	B_2
		Compressed 30%	Normal Rate
Forced-Paced	A_1	I A_1B_1	II A_1B_2
Self-Paced	A_2	III A_2B_1	IV A_2B_2

The students were randomly assigned to four groups using a random number table:

Group	Mode of Presentation	Rate of Presentation
I	Forced-Paced	30% Compressed
II	Forced-Paced	Normal Rate
III	Self-Paced	30% Compressed
IV	Self-Paced	Normal Rate

Because of the random assignment, the groups I through IV were assumed to be equivalent. The achievement score means obtained from the final examination for each group in the partitioned cell are mutually exclusive.

With the 2 x 2 factorial paradigm, three statistical hypotheses can be tested:

1. The significance of the differences between the rates of presentation (compressed and normal),

2. The significance of the differences between the mode of presentation (forced-paced and self-paced), and

3. The significance of the interaction of the two variables.

Additional information about the effects of forced pacing versus self-pacing on high and low grade point average students was obtained from the following two designs:

Mode of Presentation	Rate of presentation	
	Compressed 30%	Normal Rate
Low GPA		
Self-paced		
High GPA		

Mode of Presentation	Rate of Presentation	
	Compressed 30%	Normal Rate
Low GPA		
Forced-paced		
High GPA		

Also from the data provided from these two designs two additional paradigms were formed comparing the modes of presentation of the high grade point students and the low grade point students.

Mode of Presentation	Rate of Presentation	
	Compressed 30%	Normal Rate
Forced-Paced		
High GPA		
Self-Paced		

Mode of Presentation	Rate of Presentation	
	Compressed 30%	Normal Rate
Forced-Paced Low GPA		
Self-Paced		

A 2 x 2 factorial analysis of variance was computed to determine the effects of the rate of presentation on students' achievement scores who had low and high School-College Aptitude Test scores. The paradigms used were:

Mode of Presentation	Rate of Presentation	
	Compressed 30%	Normal Rate
Low SCAT Self-Paced		
High SCAT		

Mode of Presentation	Rate of Presentation	
	Compressed 30%	Normal Rate
Low SCAT Forced-Paced		
High SCAT		

Another 2 x 2 factorial analysis of variance was used to determine the effects of mode of presentation upon the students' achievement scores who had low and high

comprehension scores on the Nelson-Denny Reading Test. The paradigms used were:

Mode of Presentation	Rate of Presentation	
	Compressed 30%	Normal Rate
Low Comp		
Self-Paced		
High Comp		

Mode of Presentation	Rate of Presentation	
	Compressed 30%	Normal Rate
Low Comp		
Forced-Paced		
High Comp		

2 x 2 factorial analyses of variance were computed to examine the effects of the rate of presentation and the mode of presentation of male and female students. The paradigms used were:

Mode of Presentation	Rate of Presentation	
	Compressed 30%	Normal Rate
Forced-Paced		
Males		
Self-Paced		

Mode of Presentation	Rate of Presentation	
	Compressed 30%	Normal Rate
Forced-Paced Females		
Self-Paced		

2 x 2 analyses of variance were computed to examine the effect of the mode of presentation upon males and females in both compressed and normal rates of presentation. The paradigms used were:

Mode of Presentation	Rate of Presentation	
	Compressed 30%	Normal Rate
Male Forced-Paced		
Female		

Mode of Presentation	Rate of Presentation	
	Compressed 30%	Normal Rate
Male Self-Paced		
Female		

To gain a better understanding of the relationships between the various student achievements, GPA, SCAT, Nelson-Denny Reading Comprehension, Nelson-Denny Vocabulary, Nelson-

Denny Reading Rate, and the student achievement on the automated media program final examination, correlations were computed.

Correlations were computed between:

1. GPA versus Achievement scores
2. SCAT versus Achievement scores
3. Nelson-Denny Comprehension versus Achievement scores
4. Nelson-Denny Vocabulary versus Achievement scores
5. Nelson-Denny Reading Rate versus Achievement scores

CHAPTER IV

STATISTICAL ANALYSIS OF THE DATA

INTRODUCTION

In this chapter the development of the statistical data obtained from the achievement scores on the final examination, the scores from the Nelson-Denny Reading Test, the prerequisite grade point averages and the School-College Aptitude Test scores is presented.

SOME STATISTICAL DATA FOR THE GROUPS

Test Instrument Reliability

The reliability of the test instrument used to obtain the data for this study was verified using the split-half technique. The mid-term and the final examination were re-graded by counting the number of even questions that were answered correctly and correlating the result with the number of odd questions answered correctly. The two tests were combined to obtain the final examination. The Pearson product-moment correlation for alternate questions calculated to be .83. This coefficient is valid for a test one-half the length of the actual test since the split-half technique was used. The correction for this effect was accomplished by using the Spearman-Brown correction formula for split-halves test reliability. The Spearman-Brown r_{tt} = .90 is the

estimated reliability coefficient for the actual test.

The coefficient value of .90 is a strong indication that the test was able to differentiate between individuals. A t test for the significance of r was calculated and the t value of 18.46 was obtained. The t ratio at df = 80 has the value of 3.20 at p = .002 and indicates that the correlation coefficient is high enough to be significantly different from zero. In figure 2, a scatter diagram indicates a positive correlation with a minimum of scatter.

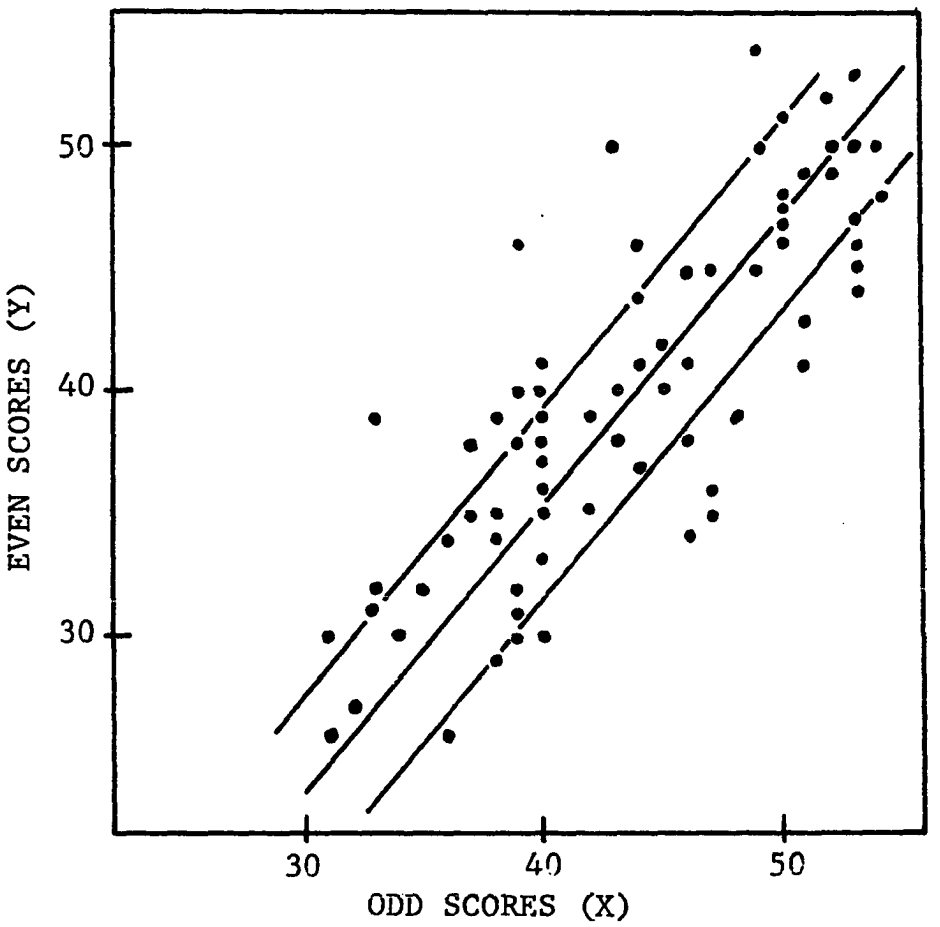

Fig. 2--Scatter Diagram for Odd vs. Even Correct Answers on Final Examination

The standard error of measurement was calculated and found to be 4.39. In figure 2, the regression line of best fit and standard error of measurement band indicate that 74% of the students' scores in the four groups fell within + or - one standard error of measurement.

Comparison of the Four Groups

In table 3, the means, mean deviations, variances and standard deviations are given for the four groups.

TABLE 3. COMPARISONS OF THE MEANS, MEAN DEVIATIONS VARIANCES AND STANDARD DEVIATIONS OF GROUP I THROUGH IV

Group	$\bar{X}$	MD	S_x	σ
I	84.95	10.33	153.05	12.371
II	81.19	9.72	166.16	12.890
III	86.05	11.45	182.46	13.508
IV	81.75	11.22	222.40	14.913
$\bar{X}..$	83.48	10.68	181.01	13.420

An F-max test was performed since the variance of group IV appeared to be abnormally high when compared to the variance of group I. F-max was calculated to be 1.45. The table value for df = 20 and 4 variances was found to be greater than the obtained value. The difference between the variances was considered insignificant at both $p < .05$ and $p < .01$.

The confidence limits of the group means was calcu-

lated and the results are shown in table 4.

TABLE 4. CONFIDENCE LIMITS OF THE GROUP MEANS

Group	$\overline{X}$	S_x	Confidence Limits + or - 1_{sx}	Variation
I	84.95	2.70	82.25 to 87.65	5.40
II	81.19	2.99	78.20 to 84.18	5.98
III	86.05	3.02	83.03 to 89.07	6.04
IV	81.75	3.33	78.42 to 85.08	6.66

Correlation of Prerequisite Tests versus Final Examination

Kerlinger[1] reports that "in order to be statistically significant, a coefficient of correlation computed between 30 pairs of measures has to be approximately .36 to be significant at the .05 level and approximately .46 at the .01 level." Correlations between larger numbers of pairs tend to be significant at slightly lower values.

The measures of relationship between the various tests scores possessed by the students prior to this study and the performance on the final examination are shown in table 5.

The significance of each Pearson r was determined by the use of a statistical table at the .05 level. The results are shown in table 6.

It appears that the correlations do not provide a consistant strong index to the success of a student in

TABLE 5. PEARSON r COEFFICIENTS

Group	n	GPA vs X	SCAT vs X	NDV vs X	NDC vs X	NDRR vs X
I	21	.07	.66	.52	.51	.24
II	21	.56	.13	.55	.14	.27
III	20	.62	.55	.29	.50	.38
IV	20	.50	.19	.12	.25	-.06

GPA - Grade Point Average
SCAT - School-College Aptitude Test
NDV - Nelson-Denny Vocabulary Score
NDC - Nelson-Denny Comprehension Score
NDRR - Nelson-Denny Reading Rate
X - Score on Final Examination

TABLE 6. THE SIGNIFICANCE OF PEARSON r FOR THE GROUP FINAL EVALUATION versus OTHER TEST SCORES AND GPA

Group	n	GPA vs X	SCAT vs X	NDV vs X	NDC vs X	NDRR vs X
I	21	ns	s	s	s	ns
II	21	s	ns	s	ns	ns
III	20	s	s	ns	s	ns
IV	20	s	ns	ns	ns	ns

$p < .05$

achievement, however there is some indication that the grade point average has some predictive value. If the grade is relatively high or relatively low the achievement scores

[1]Fred N. Kerlinger. Foundations of Behavioral Research. (New York: Holt, Rinehart and Winston, Incorporated, 1964.)

tend to be high and low respectively. Note that the reading rate appears not to be an indication of achievement success.

The Nelson-Denny Test Results

Table 7 shows the means and standard deviations of the various groups scores on the Nelson-Denny Reading Test as compared to the grade 16 (senior level) norms reported in the Examiner's Manual of the Nelson-Denny Reading Test form A.

TABLE 7. COMPARISON OF STUDENTS' SCORES AND THE NATIONAL NORMS (MEANS) FOR THE NELSON-DENNY TEST FORM A

Group	n	$\bar{X}$ Vocabulary	σ	$\bar{X}$ Comprehension	σ	$\bar{X}$-wpm Reading Rate	σ
I	21	34.23	9.94	43.61	10.21	302.66	102.44
II	21	35.80	10.12	40.09	12.20	284.57	77.28
III	20	41.30	11.61	47.30	12.45	328.25	96.87
IV	20	38.00	10.47	42.60	10.24	275.05	95.18
$\bar{X}..$*		37.27		43.36		297.53	
Norm		50.50	14.82	49.32	10.92	304.04	88.67

*The Grand Mean ($\bar{X}..$) was computed from the following equation:

$$X.. = \frac{(Xn)}{N}$$

where N is the total number of group members and n is the number of members in each group. $\bar{X}$ is the group mean.

The grand mean for the vocabulary scores of the four groups is 26.2 percent lower than the established norms for college seniors on the Nelson-Denny test. The grand mean of the comprehension scores for the four groups is 12.09 percent lower than the reported national norm and the reading rate is 2.15 percent less than the reported national norm. Table 8 reflects the position in percent of the group mean score compared to the established national norm.

TABLE 8. POSITION IN PERCENT OF THE GROUP MEANS COMPARED TO THE NATIONAL NORMS

Group	n	% Voc	% Comp	% RR
I	21	32.22 below	11.58 below	.46 below
II	21	29.11 below	18.72 below	6.41 below
III	20	18.22 below	4.10 below	7.88 above
IV	20	24.76 below	13.63 below	9.54 below
$\bar{X}$..	82	26.20 below	12.09 below	2.15 below

The School-College Aptitude Scores

The norms for the SCAT are not given since the test form and the series is unknown for each student. Some may have had the series I and others the series II. The norms are reflected in the percentile scores used in this study.

Results of the Analysis of Variance

In this study the effect of both the rate of presentation and the mode of presentation on student achievement was examined by using the 2 x 2 factorial analysis of variance. Specifically, three main questions are asked:

1. What is the main effect of the mode of presentation (forced-pacing and self-pacing) upon the student achievement scores;

2. What is the main effect of the rate of presentation (normal and compressed rate of speech) on the student achievement scores, and

3. What is the interaction effect of the rate of presentation and the mode of presentation upon the student achievement scores?

It has been established earlier in this study that the student members of the groups were randomly assigned to four groups:

Group I - Forced-paced - Compressed Rate

Group II - Forced-paced - Normal Rate

Group III - Self-paced - Compressed Rate

Group IV - Self-paced - Normal Rate

that the groups have homogeniety of variance as substantiated by the F_{max} test of variance homogeniety; and that the groups are mutually exclusive. These three assumptions have been met and therefore lay the foundation for the use of the analysis of variance to treat the data.

In testing the first null hypothesis (Ho_1);

> There is no significant difference between the mean scores of subjects who are forced-paced through an automated program and those who are self-paced through an automated program,

a 2 x 2 factorial analysis of variance was computed. The source of variation due to the pacing was not significant since the F-ratio was less than 1 ($F < 1$). The hypothesis of no difference was accepted.

The second hypothesis (Ho_2);

> There is no significant difference between the mean scores of subjects who receive the compressed version of the automated program and those who receive the normal rate version,

was also tested at the same time and found to be supported by an F-ratio significant at $p < .20$. An α level of .20 was selected to reduce the possibility of a Type II error. Hypothesis number two (Ho_2) of no significant difference between rates of presentation is rejected. Since hypothesis number two is rejected, this indicates that there is a significant difference in the achievement scores when students study materials administered at the compressed rate and those studying materials at the normal rate. The means of the groups are plotted in figure 3 indicating that the achievement of students on the final examination who had the 30 percent compressed material tend to perform at a higher level, and those who received material at the normal rate of

presentation tend to achieve at a lower level.

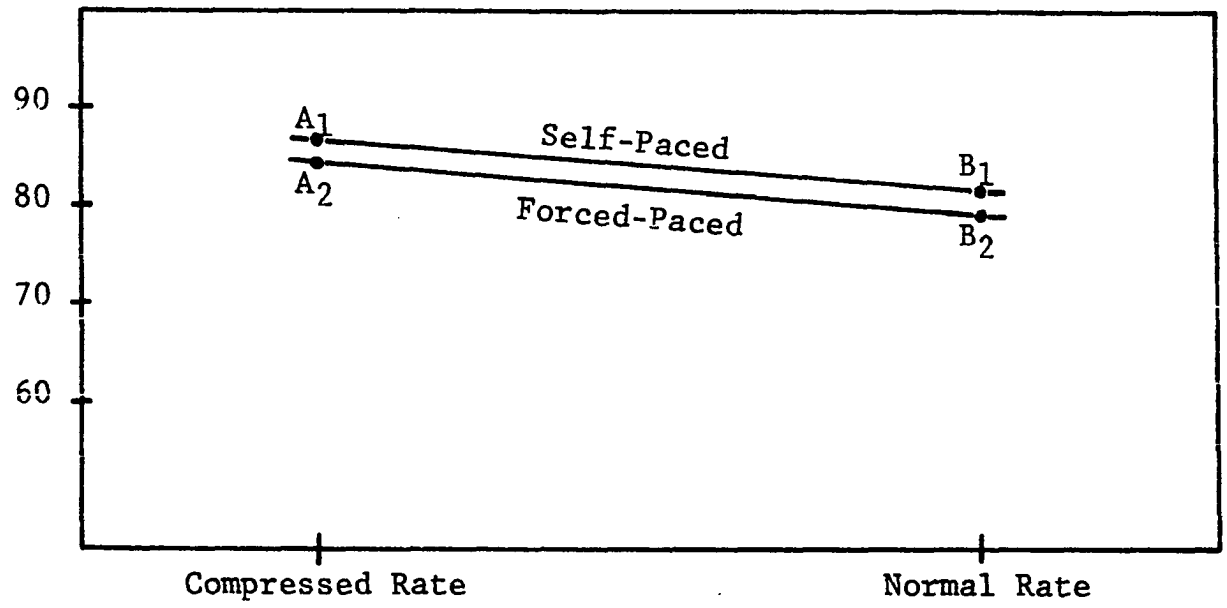

Fig. 3. Plot of the Achievement Scores versus Rate of Presentation

The slope of the line from A_1 to B_1 of -.30 is commensurate

$$\frac{Y}{X} = -.30$$

with the alpha level of .20. The closeness of the two lines support the fact that hypothesis number one is true.

Table 9 shows the results of the 2 x 2 ANOVA.

The hypothesis number three (Ho_3);

> There is no significant interaction between the mode of presentation and the rate of presentation of the program,

was accepted since the F-ratio of the interation between the

mode of presentation and the rate of presentation (compressed versus normal rate of speech) was less than one ($F < 1$). The plot of the means in figure 3 clearly indicates there is no interaction.

TABLE 9. ANALYSIS OF VARIANCE FOR MODE OF PRESENTATION VERSUS RATE OF PRESENTATION

Source of Variation	SS	df	MS	F
Between Modes	13.61	1	13.61	ns
Between Rates	324.01	1	324.01	1.74
Interaction (M x R)	1.51	1	1.51	ns
Error Variance	14,076.83	76	185.22	
Total	14,415.96	79		

$p < .20$

Hypothesis number four;

> There is no significant difference between the achievement of subjects classified as high achievers and those who are classified as low achievers when the pacing is controlled and the program is controlled,

was first tested by separating the six highest and six lowest grade point averages and the corresponding achievement scores from each forced paced group cell and computing a 2 x 2 factorial ANOVA between the high and low achievement scores. The results of this ANOVA is presented in table 10.

The between levels F-ratio of 5.15 is significant at $p < .05$ indicating that there is a significant difference

in the achievement score means at that level when a comparison is made between students with high grade point averages and those who have low grade point averages. The F-ratio of 3.33 is significant at $p < .10$ indicating that there is a significant difference at that level in the rate the material is presented.

TABLE 10. ANALYSIS OF VARIANCE FOR HIGH GRADE POINT AVERAGE AND LOW GRADE POINT AVERAGE STUDENTS FORCED-PACED

Source of Variation	SS	df	MS	F
Between Levels	737.04	1	737.04	5.15[1]
Between Rates	477.04	1	477.04	3.33[2]
Interaction (L x R)	92.04	1	92.04	ns
Error Variance	2,861.83	20	143.09	
Total	4,167.95	23		

[1] $p < .05$

[2] $p < .10$

A plot of the means is shown in figure 4. From the graph, the slope of line A_1B_1 is -.35 and the slope of A_2B_2 is -.91. The -.35 slope indicates that there is a slight decrease in the achievement scores of the students who had high grade point averages and the slope of -.91 indicates that the change in the achievement scores of students who had low grade point averages was significantly greater. The students with low grade point averages did better at the

compressed rate than they did at the normal rate; however, the low achievers still fell below the high achievers in achievement scores. Table 11 shows the mean grade point

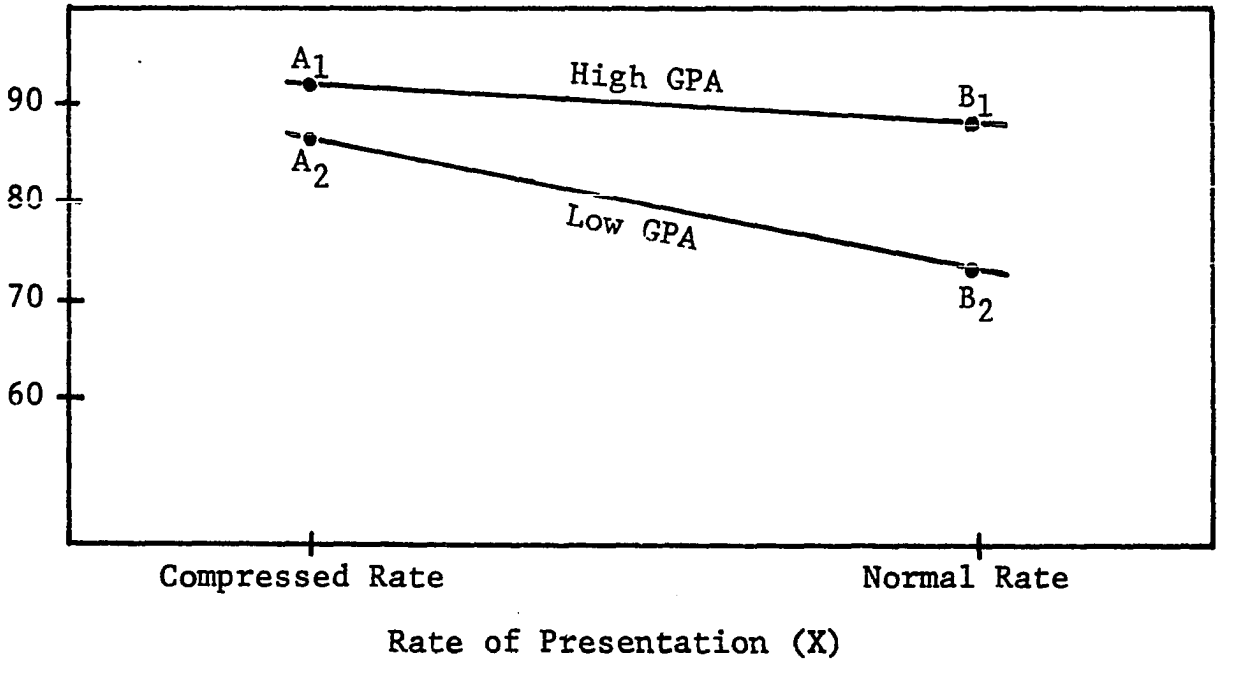

Fig. 4. Plot of High Grade Point Average versus Low Grade Point Average-Forced-Paced

averages and achievement scores of the high and low achievers

TABLE 11. GPA MEANS OF FORCED PACED GROUPS I AND II

Group	$\bar{X}$ GPA(low)	$\bar{X}$ Score(low)	$\bar{X}$ GPA(high)	$\bar{X}$ Score(high)
I	2.38	85.66	3.63	92.83
II	2.44	72.83	3.55	87.83

in forced paced groups I and II. Hypothesis number four was

tested again by separating the six highest scores and the six lowest scores from each self-paced group cell and computing a 2 x 2 factorial analysis of variance between the high GPA and low GPA. Table 12 shows the results of the ANOVA.

TABLE 12. ANALYSIS OF VARIANCE FOR HIGH GRADE POINT AVERAGE AND LOW GRADE POINT AVERAGE STUDENTS-SELF-PACED

Source of Variation	SS	df	MS	F
Between Levels	1,855.04	1	1,855.04	13.48
Between Rates	57.04	1	57.04	ns
Interaction (L x R)	2.04	1	2.04	ns
Error Variance	2,751.83	20	137.59	
Total	4,665.95			

$p < .005$

The F-ratio of 13.48 is significant at $p < .005$. This indicates a significant difference in the achievement scores of the high and low achievers. There is not a significant difference in the rates of presentation, however there is a slight difference in the means in favor of the compressed rate. Table 13 shows the mean grade point averages and achievement score means of high and low achievers in self-paced groups III and IV. Notice that in both cases, self-paced and forced-paced, that the achievement scores of the high and low achievers show a decline at the normal rate.

The plot in figure 5 of lines A_1B_1 and A_2B_2 clearly shows a significant difference in the achievement levels.

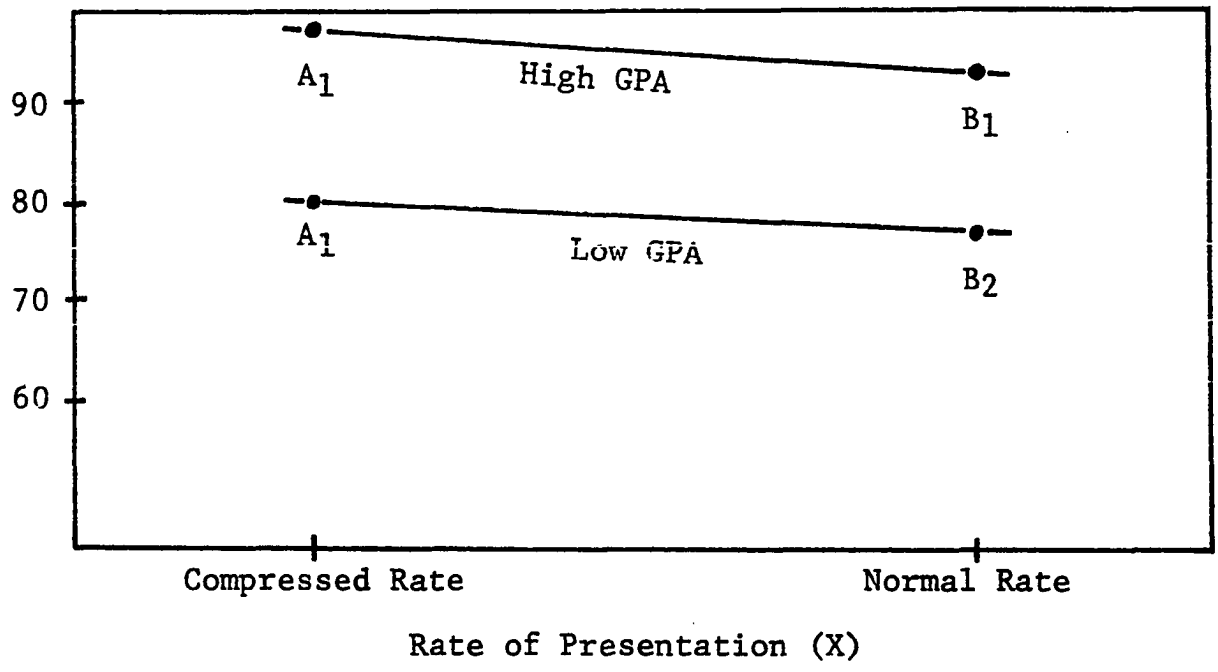

Fig. 5. Plot of the High Grade Point Average versus Low Grade Point Average Achievement Score-Self-Paced

The low slope values of A_1B_1 and A_2B_2 are commensurate with the $F<1$ ratio. The slope of A_1B_1 is -.26 and the slope of A_2B_2 is -.17. Hypothesis four is rejected. There is a

TABLE 13. GPA MEANS OF SELF-PACED GROUPS III AND IV

Group	$\bar{X}$ GPA(low)	$\bar{X}$ Score(low)	$\bar{X}$ GPA(high)	$\bar{X}$ Score(high)
III	2.65	80.00	3.85	98.16
IV	2.46	77.50	3.68	94.50

significant difference in achievement scores between students who are high achievers and those who are low achievers.

To test hypothesis four with regard to the effect of the mode of presentation upon the high achievers using the grade point average as a basis of selection, a 2 x 2 analysis of variance was computed first with the high achiever achievement scores. The six highest grade point averages and accompanying achievement scores were separated from the forced-paced and self-paced population in both the compressed and normal rates of presentation groups.

The results of the ANOVA are shown in table 14.

TABLE 14. ANALYSIS OF VARIANCE BETWEEN THE FORCED-PACED AND SELF-PACED GROUPS ACHIEVEMENT SCORES FOR STUDENTS WITH HIGH GRADE POINT AVERAGES

Source of Variation	SS	df	MS	F
Between Modes	216.00	1	216.00	2.24[1]
Between Rates	112.67	1	112.67	ns[2]
Interaction (M x R)	2.67	1	2.67	ns
Error Variance	1,926.00	20	96.30	
Total	2,257.34	23		

[1] $p < .20$ [2] $p < .20$

The F-ratio was significant at $p < .20$ indicating a significant difference in achievement scores due to the effect of the mode of presentation. Students who are

designated as high achievers on the basis of their grade point averages tend to do better in the self-paced mode of presentation.

Figure 6 shows a plot of the achievement score means of those who have high grade point averages in the compressed and normal rates of presentation groups and were in the forced-paced and self-paced groups.

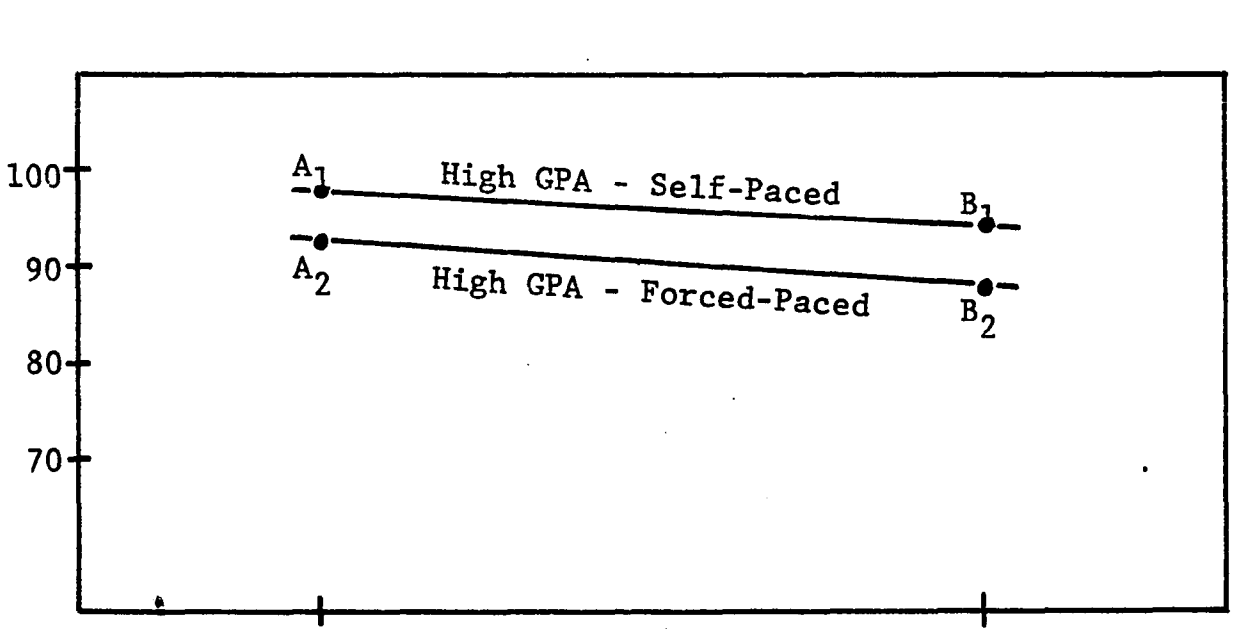

Fig. 6. Plot of High Grade Point Average Achievement Scores versus the Mode of Presentation

The slopes of both A_1B_1 and A_2B_2 are both negative. The Means

$$(A_1B_1) \quad \frac{Y}{X} = -.35 \qquad (A_2B_2) \quad \frac{Y}{X} = -.26$$

are higher at the compressed rate of presentation however,

they are not significantly higher than the means at the normal rate. The hypothesis of no difference between the mode of presentation is rejected. High grade point average students score better on achievement tests when allowed to self-pace themselves through the automated program. The rate of presentation does not have a significant effect upon the achievement.

To test hypothesis four with regard to the effect of the mode of presentation upon the achievement of low achievers a second 2 x 2 analysis of variance was computed. The results of the ANOVA are shown in table 15.

TABLE 15. ANALYSIS OF VARIANCE BETWEEN THE FORCED-PACED AND SELF PACED GROUPS ACHIEVEMENT SCORES FOR STUDENTS WITH LOW GRADE POINT AVERAGES

Source of Variation	SS	df	MS	F
Between Modes	1.50	1	1.50	ns
Between Rates	352.66	1	352.66	1.91
Interaction (M x R)	160.17	1	160.17	ns
Error Variance	3,687.67	20	184.38	
Total	4,202.00	23		

$p < .20$

The F-ratio was significant at $p < .20$ indicating a significant difference in achievement due to the rate of presentation but not a significant difference in achievement due to the mode of presentation.

Students who are designated as low achievers tend to achieve at a higher level at the compressed rate but the mode of presentation is inconsequential.

Figure 7 shows a plot of the achievement score means of those who have low grade point averages in the forced and self-paced groups and in the compressed and normal rate groups.

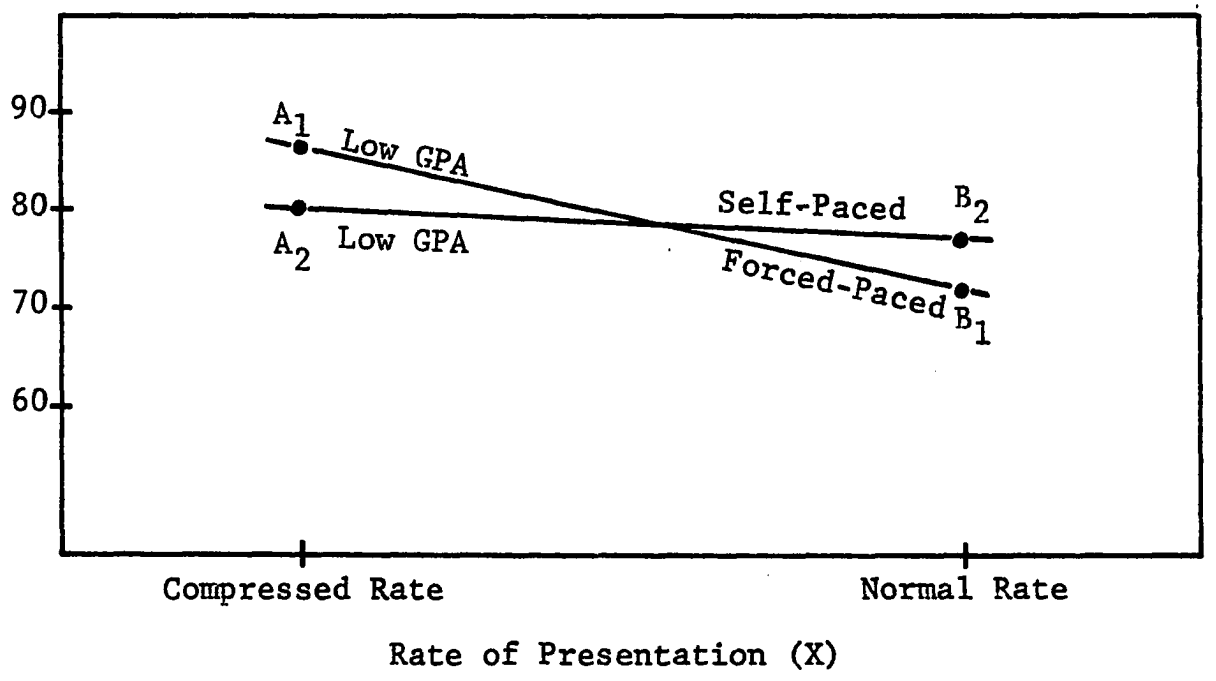

Fig. 7. Plot of the Low GPA Achievement Scores versus the Mode of Presentation

The slopes of the lines A_1B_1 and A_2B_2 are -.91 and -.17. Although the plot indicates there is an interaction, the ANOVA does not indicate the interaction is significant.

The grade point averages and means of the corresponding achievement scores are shown in tables 11 and 13.

That portion of hypothesis four stating that there is no difference in the achievement scores of low achievers (based on the grade point average) who are self-paced or forced-paced is retained. Low grade point average students do better with the compressed speech version but the mode of presentation appears to be of no consequence.

Related Statistics Concerning the School College Aptitude Test and the Nelson-Denny Comprehension Scores.

School College Aptitude Test - Forced Paced. Hypothesis four (Ho_4) is retested using the SCAT scores as the criterion to designate the students as high achievers and low achievers in the forced-paced mode of presentation. The six highest and six lowest SCAT scores accompanied by the corresponding achievement scores were separated from the forced-paced population and formed into a 2 x 2 factorial paradigm.

A 2 x 2 factorial analysis of variance was computed to test for significance between the achievement scores of those students who scored high and low on the School College Aptitude Test in the forced-paced version of the automated program. The results of the ANOVA are shown in table 16.

The F-ratio was significant at $p < .01$ between the achievement levels, high achievers and low achievers. The F-ratio was significant at $p < .20$ between the speech rates, compressed and normal. The F-ratio, although greater than 1 was not sufficiently high to indicate interaction between

the achievement level and the rate of presentation. A null hypothesis of no difference between the achievement levels and rates of presentation is rejected.

TABLE 16. ANALYSIS OF VARIANCE BETWEEN THE ACHIEVEMENT SCORES OF STUDENTS SCORING HIGH AND LOW ON THE SCHOOL-COLLEGE APTITUDE TEST - FORCED-PACED

Source of Variation	SS	df	MS	F
Between Levels	1,190.04	1	1,190.04	8.76[1]
Between Rates	301.04	1	301.04	2.21[2]
Interaction (L x R)	187.04	1	187.04	ns
Error Variance	2,715.83	20	135.79	
Total	4,393.95	23		

[1] $p < .01$

[2] $p < .20$

Figure 8 shows a plot of the achievement score means of those who scored high on the School-College Aptitude Test and those who scored low on the School-College Aptitude Test in the forced-paced version of the automated program.

The slope of A_1B_1 is -.90 indicating a difference in achievement levels affected by the speech rates and the slope of A_2B_2 is -.10 indicating a slight decline. Although it is not possible to state that the differences are sig-

nificant from the plots, the differences are clearly there and are substantiated by the F-ratio obtained from the ANOVA.

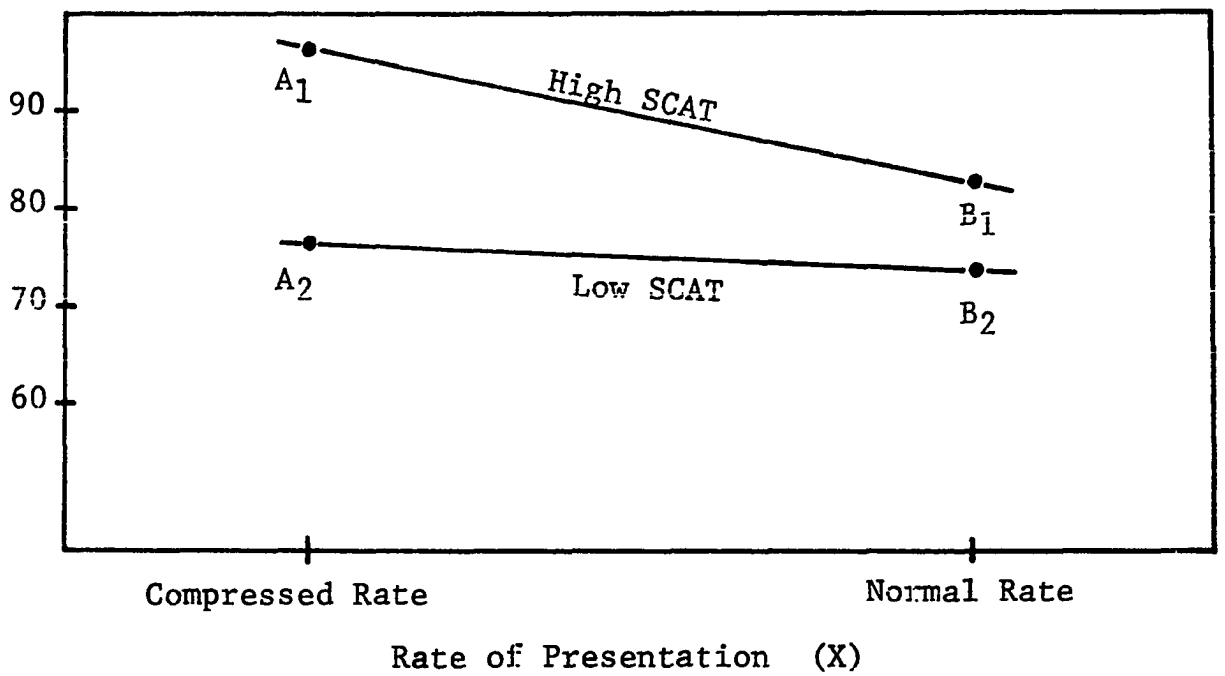

Fig. 8. Plot of High SCAT versus Low SCAT Achievement Scores-Forced-Paced

There is not an indication of interaction in the graph and this is supported by an insignificant F-ratio obtained in the ANOVA. Table 17 shows the mean of the SCAT scores and achievement scores of the high and low achievers in the forced-paced groups I and II.

The students who have obtained a high SCAT score tend to do better with the compressed form of the automated program and with the forced-paced mode of presentation. Those students with a low SCAT score appear not to excel

appreciably in either mode of presentation.

TABLE 17. SCAT SCORES AND ACHIEVEMENT SCORES FORCED-PACED GROUPS I AND II

Group	X SCAT(low)	X Score(low)	X SCAT(high)	X Score(high)
I	24.16	76.16	82.66	95.83
II	29.50	74.66	81.66	83.16

School-College Aptitude Test - Self-Paced. The six highest and the six lowest SCAT scores accompanied by the corresponding achievement scores were separated from the self-paced population and formed into a 2 x 2 factorial paradigm.

A 2 x 2 factorial analysis of variance was computed to test for significance between the means of the achievement scores of those students who scored high and low on the School-College Aptitude Test in the self-paced version of the automated program. The results of the ANOVA are shown in table 18.

The F-ratio is significant between the achievement levels at $p < .05$, however, the results of the ANOVA indicate that there is no significant difference between the rates of presentation or an interaction between the achievement levels and the rates of presentation. A null hypothesis of no difference between the achievement levels is rejected and a hypothesis of no difference between the rates of

presentation is accepted. Students who have a high SCAT score tend to score at a higher achievement level than

TABLE 18. ANALYSIS OF VARIANCE BETWEEN THE ACHIEVEMENT SCORES OF STUDENTS SCORING HIGH AND LOW ON THE SCAT - SELF-PACED

Source of Variation	SS	df	MS	F
Between Levels	962.66	1	962.66	5.21
Between Rates	54.00	1	54.00	ns
Interaction (L x R)	170.66	1	170.66	ns
Error Variance	3,694.00	20	184.69	
Total	4,881.33	23		

$p < .05$

those who have a low SCAT score but apparently the rate of presentation of the material is of no consequence when the students are allowed to pace themselves.

Figure 9 is a plot of the achievement scores of those who scored high and low on the SCAT and who engaged in the self-paced automated program both in the compressed and normal rate of presentation.

The slope of A_1B_1 is -.59 representing a difference in achievement of those students who were engaged in the compressed rate program and those who were engaged in the normal rate program. The mean of the compressed group achievement scores was higher. A_2B_2 has a positive slope of

.16 representing that the mean achievement score of the students engaged in the normal rate program who had low SCAT scores tend to score higher when they are allowed to pace themselves and engage in the normal rate mode of presentation. Note that in the forced paced plot, the normal rate students with low SCAT scores achieved at a lower level than the students at the compressed rate.

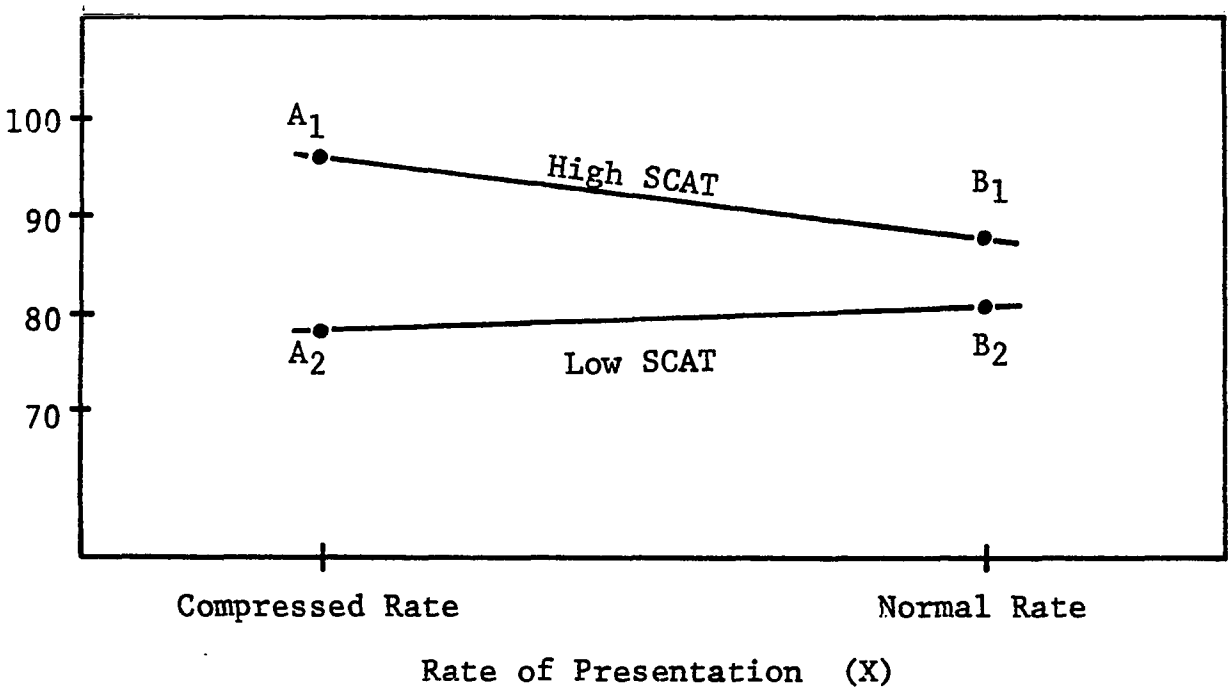

Fig. 9. Plot of the High SCAT Achievement Scores - Self-Paced

Table 19 shows the mean SCAT scores and achievement scores of the high and low achievers in the self-paced groups III and IV.

Hypothesis four is again rejected. Students

classified as high achievers based on their SCAT scores do score significantly higher than those students classified as low achievers. In addition, there is a significant difference between the achievement scores effected by the rate of presentation when the students are forced-paced through the program.

TABLE 19. SCAT SCORES AND ACHIEVEMENT SCORES OF SELF-PACED GROUPS III AND IV

Group	$\bar{X}$ SCAT(low)	$\bar{X}$ Score(low)	$\bar{X}$ SCAT(high)	$\bar{X}$ Score(high)
III	32.16	78.16	84.00	96.16
IV	28.33	80.50	82.50	87.83

Nelson-Denny Comprehension Scores - Forced-Paced. Hypothesis four (Ho_4) was retested for the forced-paced mode of presentation using the Nelson-Denny comprehension scores as the basis of determining if the students were high or low achievers. The six highest and the six lowest Nelson-Denny comprehension scores accompanied by the corresponding achievement scores were separated from the forced-paced population and formed into a 2 x 2 factorial paradigm.

A 2 x 2 factorial analysis of variance was computed to test for significance between the means of the achievement scores of those students who scored high and low on the comprehension portion of the Nelson-Denny Reading Test in the forced-paced version of the automated program. The results of the ANOVA are shown in Table 20.

TABLE 20. ANALYSIS OF VARIANCE BETWEEN THE ACHIEVEMENT SCORES OF STUDENTS SCORING HIGH AND LOW ON THE NELSON-DENNY COMPREHENSION TEST - FORCED-PACED

Source of Variation	SS	df	MS	F
Between Levels	816.66	1	816.66	7.64
Between Rates	.16	1	.16	ns
Interaction (L x R)	104.16	1	104.16	ns
Error Variance	2,137.00	20	106.84	
Total	3,057.99	23		

$p < .025$

The F-ratio is significant between the achievement

levels at $p < .025$. The results of the ANOVA indicate no significant difference due to the rate of presentation. A null hypothesis of no difference between the achievement levels is rejected and the null hypothesis of no difference between the rates of presentation is retained. Students who have obtained a high comprehension score on the Nelson-Denny Reading Test appear to score significantly higher than those who have a low comprehension score on the Nelson-Denny Reading Test. The rate of presentation of the automated program apparently does not sufficiently effect the achievement score.

Figure 10 is a plot of the achievement scores of those who scored high and low on the comprehension portion of the Nelson-Denny Reading Test and who engaged in the forced-paced automated program both in the compressed and normal rates of speech.

The slope of line A_1B_1 is -.28 and the slope of the line A_2B_2 is a positive slope of .30. The low slope values are commensurate with the results of the ANOVA which had an F-ratio of less than 1 relating to the insignificant effect of the rate of presentation on the achievement scores. The spread of the two lines is a graphic representation of the significant difference in the achievement levels attained by students having a low comprehension score and those having a high comprehension score on the Nelson-Denny Reading Test.

Although the positive slope on the graph indicates that those who have a low comprehension score do appear to score higher when engaging in a program at the normal rate of presentation, this achievement score is not significantly higher as shown by the ANOVA.

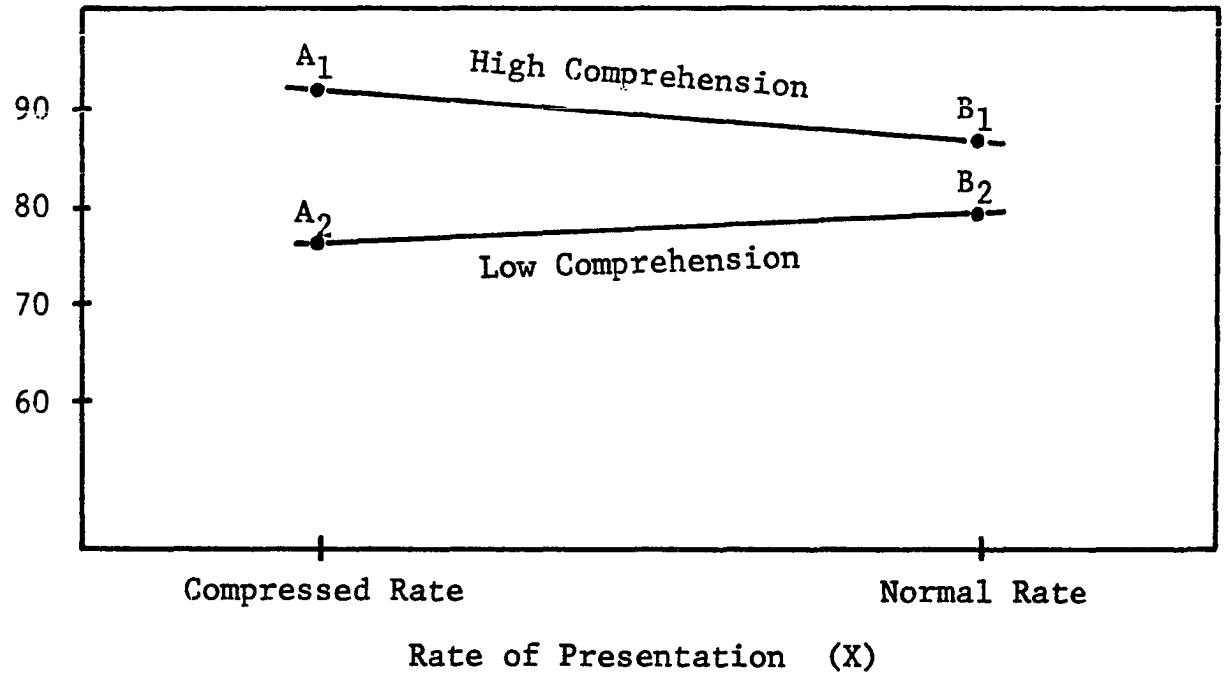

Fig. 10. Plot of the High Nelson-Denny Comprehension Scores versus Low Nelson-Denny Comprehension Scores-Forced-Paced

Table 21 shows the mean comprehension scores and corresponding achievement scores of the high and low achievers on the Nelson-Denny Reading Test in the forced-paced groups I and II.

TABLE 21. COMPREHENSION SCORES AND ACHIEVEMENT SCORES OF FORCED-PACED GROUPS I AND II - NELSON-DENNY TEST

Group	$\bar{X}$ NDC(low)	$\bar{X}$ Score(low)	$\bar{X}$ NDC(high)	$\bar{X}$ Score(high)
I	31.00	75.50	56.00	91.33
II	26.66	79.83	54.33	87.33

Nelson-Denny Comprehension Score - Self-Paced. The six highest and the six lowest Nelson-Denny Comprehension scores accompanied by the corresponding achievement scores were separated from the self-paced population and formed into a 2 x 2 factorial paradigm.

A 2 x 2 factorial analysis of variance was computed to test for significance between the means of the achievement scores of those students who scored high and low on the comprehension portion of the Nelson-Denny Reading Test in the self-paced version of the automated program. The results of the ANOVA are shown in Table 22.

The F-ratio is significant at $p < .05$ between the achievement levels of the low and high comprehension achievers. The F-ratio concerning the effect of the speech rates upon achievement is less than 1 and therefore insignificant. Apparently the rate of presentation in the self-paced mode of presentation is inconsequential in effect upon the achievement scores. A null hypothesis of no difference between the achievement levels is rejected and the null hypothesis of no difference between the rates of speech is retained.

TABLE 22. ANALYSIS OF VARIANCE BETWEEN THE ACHIEVEMENT SCORES OF STUDENTS SCORING HIGH AND LOW ON THE NELSON-DENNY COMPREHENSION TEST-SELF-PACED

Source of Variation	SS	df	MS	F
Between Levels	876.04	1	876.04	4.43
Between Rates	22.04	1	22.04	ns
Interaction (L x R)	15.04	1	15.04	ns
Error Variance	3,947.83	20	197.39	
Total	4,860.95	23		

$p < .05$

Figure 11 is a plot of the achievement scores of those who scored high and low on the comprehension portion of the Nelson-Denny Reading Test and who engaged in the self-paced automated program both in the compressed and normal rates of speech.

The negative slope of line A_1B_1 is -.25 compared to the negative slope of A_2B_2 of -.02. The slope of -.02 indicates practically no fluctuation. The ANOVA supports the graphic representation. Both slopes being of low value are not significantly different from zero. However, the spread of the two lines, A_1B_1 and A_2B_2 is a graphic representation of the significant F-ratio between the achievement levels of high and low achievers as supported by the ANOVA. Apparently the speech rates in the self-paced mode of presentation have no effect upon the achievement scores.

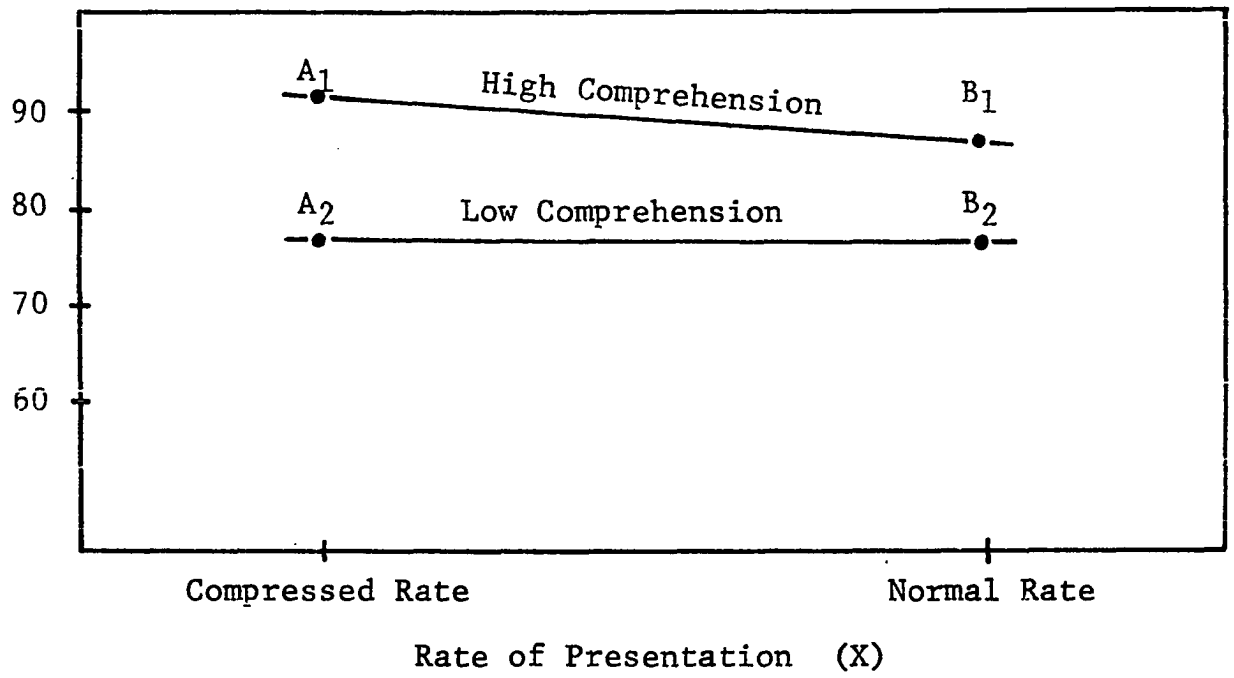

Fig. 11. Plot of the High Nelson-Denny Comprehension Scores versus Low Nelson-Denny Comprehension Scores-Self-Paced

Table 23 shows the mean comprehension scores and corresponding achievement scores of the high and low achievers on the Nelson-Denny Reading Test in the self-paced groups III and IV.

TABLE 23. COMPREHENSION SCORES AND ACHIEVEMENT SCORES OF SELF-PACED GROUPS III AND IV ON THE NELSON-DENNY READING TEST

Group	$\bar{X}$ NDC(low)	$\bar{X}$ Score(low)	$\bar{X}$ NDC(high)	$\bar{X}$ Score(high)
III	32.66	77.16	60.33	90.83
IV	31.33	76.83	54.00	87.33

Hypothesis four is rejected both in the forced-paced and self-paced mode of presentation. There is a significant difference in the achievement scores of students who are designated high achievers on the basis of their high scores on the Nelson-Denny Reading Comprehension Test.

The Effects of the Rate of Presentation and the Mode of Presentation upon Students of the Same and Opposite Sex

Male Students-Forced-Paced versus Self-Paced. To test Hypothesis number five (Ho_5):

> There is no significant difference between the achievement of male students who received the compressed version of the automated program in both modes of presentation and those who receive the normal rate version in both modes of presentation.

a 2 x 2 factorial analysis of variance was computed between the effects of the mode of presentation and the rate of presentation for male students. The results of the ANOVA are shown in Table 24.

TABLE 24. ANALYSIS OF VARIANCE FOR THE ACHIEVEMENT SCORES OF MALE STUDENTS IN BOTH RATES OF PRESENTATION AND BOTH MODES OF PRESENTATION

Source of Variation	SS	df	MS	F
Between Modes	7.00	1	7.00	ns
Between Rates	54.69	1	54.69	6.58[1]
Interaction (M x R)	53.21	1	53.21	6.40[2]
Error Variance	648.91	78	8.31	
Total	763.81	81		

[1] $p < .025$ [2] $p < .025$

The F-ratio of less than 1 indicated there is no significant difference between the male achievement scores in either mode of presentation however, the male students tend to achieve at a higher level when they receive the automated program in the compressed form. The interaction effect of the mode of presentation and the rate of presentation was significant at $p < .025$. Male students then do achieve at a higher level when they receive the program at an accelerated rate and when they are forced-paced.

A plot of the cell means is shown in figure 12.

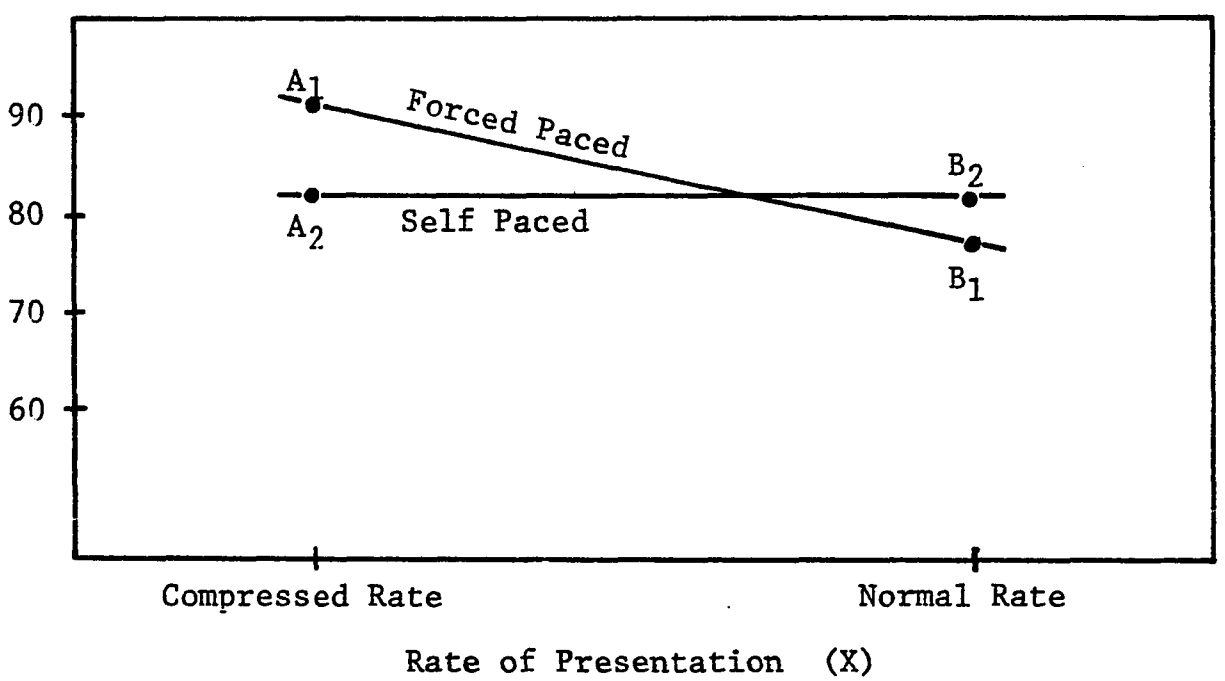

Fig. 12. Plot of the Achievement Scores of Males in Both Modes of Presentation and Both Rates of Presentation

The portion of hypothesis number five stating there

is no difference between the mode of presentation upon male achievement scores is retained and the portion stating that there is no difference between the rate of presentation if rejected.

Female Students - Forced-Paced versus Self-Paced.

To test Hypothesis number 6 (Ho_6):

> There is no significant difference between the achievement of female students who receive the compressed version of the automated program in both modes of presentation and those who receive the normal rate version in both modes of presentation.

a 2 x 2 factorial analysis of variance was computed between the effects of the mode of presentation and rate of presentation for female students. The results of the ANOVA are shown in Table 25.

TABLE 25. ANALYSIS OF VARIANCE FOR THE ACHIEVEMENT SCORES OF FEMALE STUDENTS IN BOTH RATES OF PRESENTATION AND BOTH MODES OF PRESENTATION.

Source of Variation	SS	df	MS	F
Between Modes	9.30	1	9.30	ns
Between Rates	1.06	1	1.06	ns
Interaction (M x R)	23.71	1	23.71	3.05
Error Variance	605.66	78	7.76	
Total	639.73	81		

$p < .10$

The F-ratio for both main effects, the rates of

presentation and the mode of presentation, indicate the differences in the achievement scores were insignificant. The female students do as well with either rate of presentation and either mode of presentation. The F-ratio for the interaction effect indicates, however, that the relationship between mode of presentation and the rate of presentation is significant at $p < .10$. Female students achieve at a higher level when self-paced at the compressed rate and achieve at a higher level when forced-paced at the normal rate.

A plot of the cell means is shown in figure 13.

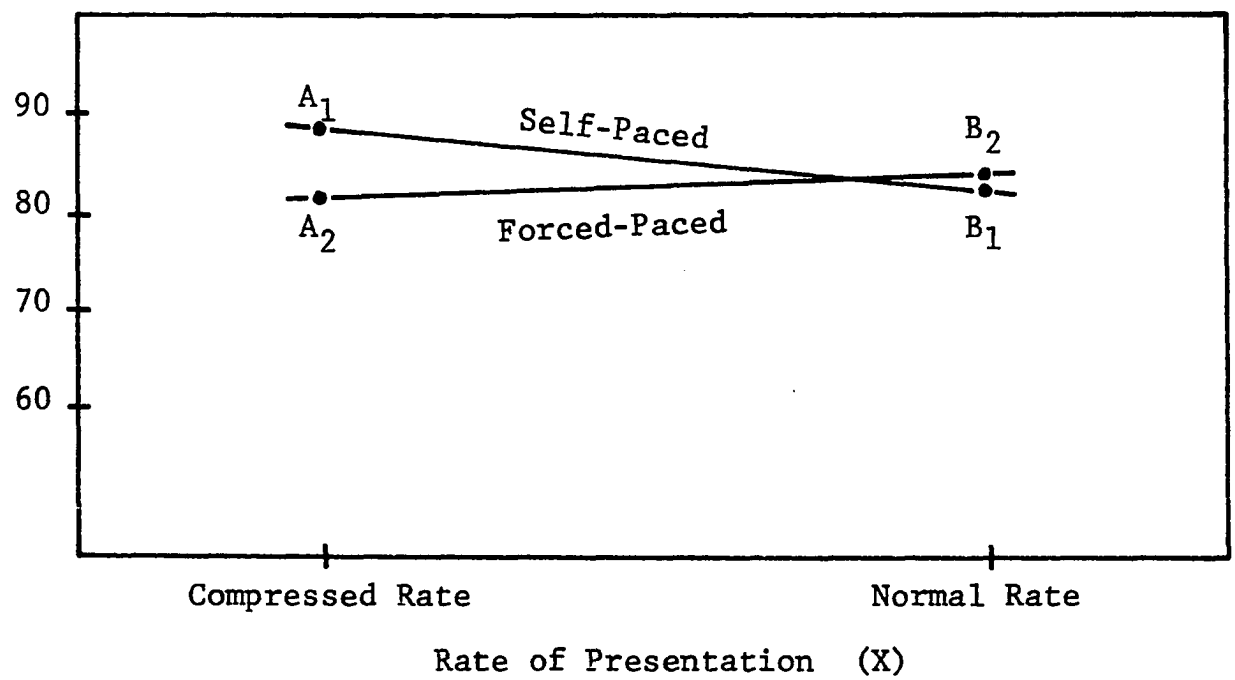

Fig. 13. Plot of the Achievement Scores of Females in Both Modes of Presentation and Both Rates of Presentation

Hypothesis Number six is retained.

Male versus Female Students - Forced-Paced. To test Hypothesis number seven (Ho_7):

> There is no significant difference between the achievement of male and the achievement of female students who receive the compressed version of the automated program and those who receive the normal rate version in the forced-paced mode of presentation

a 2 x 2 factorial analysis of variance was computed between the effects of the rates of presentation upon the achievement scores of males and females in the forced-paced mode. The results of the ANOVA are shown in Table 26.

TABLE 26. ANALYSIS OF VARIANCE BETWEEN THE ACHIEVEMENT SCORES OF MALE AND FEMALE STUDENTS IN THE FORCED-PACED MODE OF PRESENTATION

Source of Variation	SS	df	MS	F
Between Sexes	4.39	1	4.39	ns
Between Rates	29.43	1	29.43	4.67[1]
Interaction (S x R)	85.83	1	85.83	13.62[2]
Error Variance	491.90	78	6.30	
Total	611.55	81		

[1] $p < .05$

[2] $p < .001$

The F-ratio of less than 1 indicates there is no significant difference between the male and female students in the forced-paced mode of presentation however, the F-ratio for the effect of the rate of presentation of the material

is significant at $p \leq .05$. The interaction effects are significant at $p \leq .001$, an indication there is a relationship between the rates of speech and the sex of the student.

Female students tend to achieve at a higher level when the material is presented at the normal rate in the forced paced mode and male students tend to achieve at a higher level when the material is presented at the compressed rate in the forced-paced mode.

Figure 14 shows a plot of the cell means for the male and female students in the forced-paced mode.

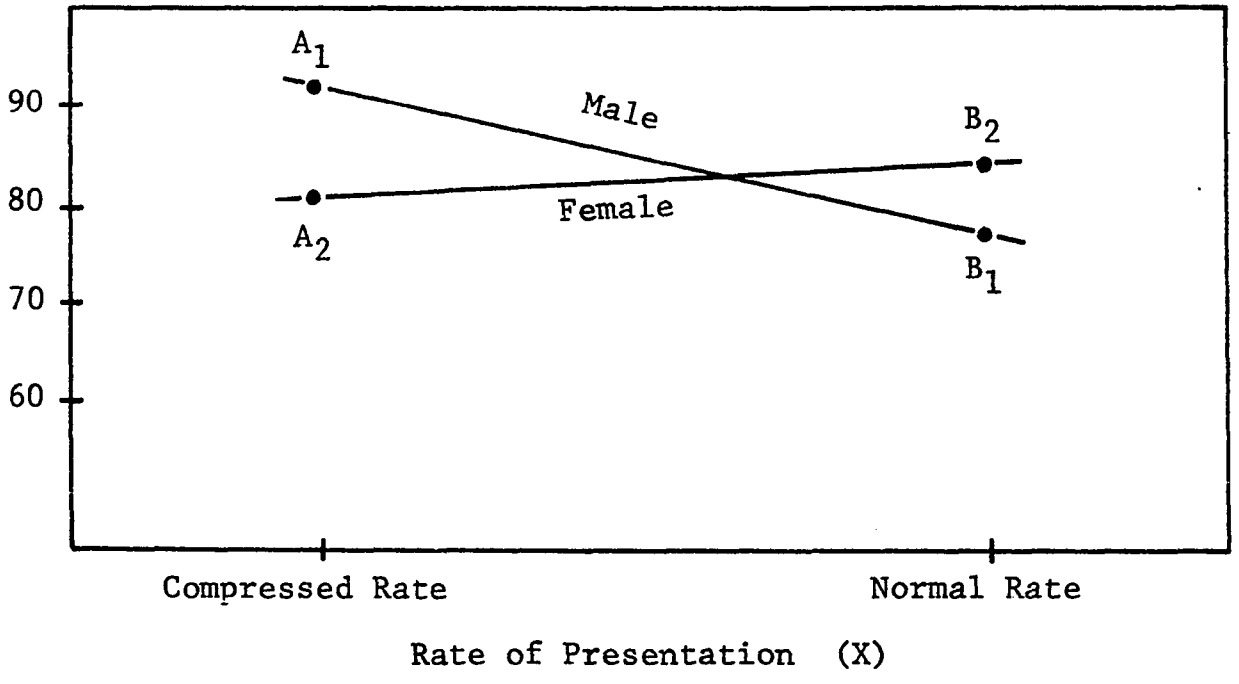

Fig. 14. Plot of the Achievement Scores of Males and Females in the Forced-paced Mode.

Hypothesis number seven is retained for that portion stating

there is no significant difference between the male and female achievement scores in the forced-paced mode but rejected for that portion stating there is no significant difference between the achievement scores due to the rate of presentation.

Male versus Female Students - Self-Paced. To test Hypothesis number eight (Ho_8):

> There is no significant difference between the achievement of male and the achievement of female students who receive the compressed version of the automated program and those who receive the normal rate version of the automated program in the self-paced mode

a 2 x 2 factorial analysis of variance was computed between the effects of the rates of presentation upon the achievement scores of male and female students in the self-paced mode. The results of the ANOVA are shown in Table 27.

TABLE 27. ANALYSIS OF VARIANCE BETWEEN THE ACHIEVEMENT SCORES OF MALE AND FEMALE STUDENTS IN THE SELF-PACED MODE OF PRESENTATION

Source of Variation	SS	df	MS	F
Between Sexes	12.96	1	12.96	ns
Between Rates	9.00	1	9.00	ns
Interaction (S x R)	8.41	1	8.41	ns
Error Variance	826.41	78	10.59	
Total	856.78	81		

$p < .20$

From Table 28 it can be seen that there is not a significant difference between the achievement scores of males and females due to either the self-paced mode of presentation or the rate of presentation. The F-ratio for the interaction is less than 1.

A plot of the achievement score means is shown in Figure 15.

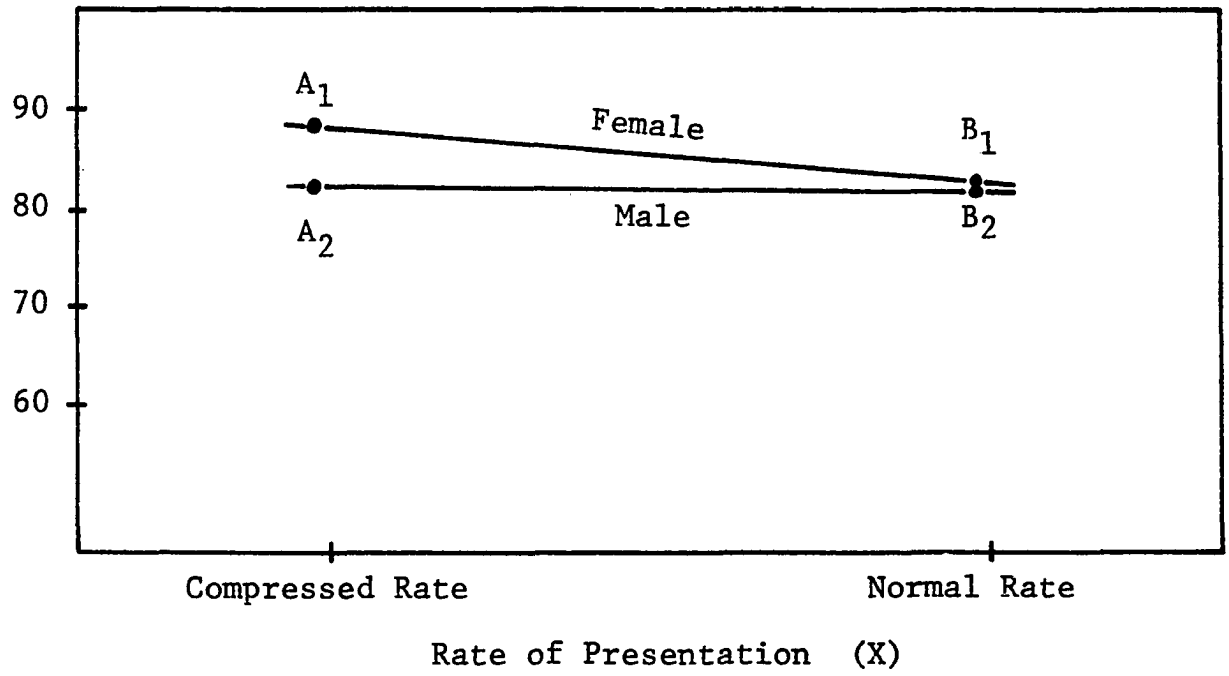

Fig. 15. Plot of the Achievement Scores of Males and Females in the Self-Paced Mode.

Hypothesis number eight is accepted.

Time Used in the Automated Media Program

From the student time sheets the viewing duration of each of the sixteen lessons was compiled to obtain the mean total time used by the self-paced normal and compressed rate groups. The forced-paced students did not keep a time sheet since the program was controlled and the time duration was the same as the actual running time of the automated program. Table 28 shows the time used by each group.

TABLE 28. TIME USED IN THE AUTOMATED PROGRAM

Group	Speech Rate	Time Used[1]	Timed Saved	%
I	Forced-Paced-Compressed	203.89	87.58	30.10
II	Forced-Paced-Normal	291.47		
III	Self-Paced-Compressed	252.69	82.92	24.80
IV	Self-Paced-Normal	335.61		

[1]Total Length of the Program for all Sixteen Lessons

The time saved by those students engaged in the forced-paced program at the compressed rate was 87.58 minutes. This is a 30.10 percent time saving which is very near the target compression rate of 30%. The self-paced students, although the time keeping by each student was at times inaccurate, saved 82.92 minutes by engaging in the compressed program compared to those who engaged in the self-paced normal rate program. This was a time savings of 24.80 per-

cent.

The self-paced normal rate group took 131.72 minutes longer to complete the program than the forced-paced compressed groups. This means that 39.2 percent more time was taken by the self-paced groups at the normal rate to complete the program than the forced-paced groups at the compressed rate.

Students were allowed to replay the tapes and take notes and otherwise use as much time as they wanted in the self-paced groups. The forced-paced groups were allowed to take notes but only during the time the program was running. The tapes were not replayed for the forced-paced groups.

The composite of the student time sheets is in Appendix H.

The F-ratio of the analysis of variance to test Hypothesis number one indicated that there was no significant difference in achievement scores of the students who were forced-paced and those who were self-paced. However, even though the students' scores were not affected appreciably, the students who were forced-paced did in fact learn as much material as the self-paced students and they did it in less time.

RESULTS OF THE OPINIONAIRE

In addition to the data collected to be treated statistically, an opinionaire was given to each student. It was separated into two parts. Part I was coordinated for those who were given the normal rate program and Part II was coordinated for those who were given the compressed rate program. Statements were selected which deal directly with compressed speech, automated programs, and total evaluation of the 4001 Competency in Instructional Media course. The data was not treated statistically. The opinionaire is included in Appendix I.

Normal Rate:

Statement: The lessons provided too much media information.

Group	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Total Responses
I	8	4	4	3	2	21
IV	3	5	8	1	3	20

In the forced-paced group, 38 percent disagreed that there was too much information in the tapes. In the self-paced groups 40 percent were neutral and only 15 percent totally disagreed.

Statement: I found it hard to discipline myself to listen attentively.

Group	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Total Responses
II	2	2	6	2	9	21
IV	4	1	1	6	8	20

In the forced-paced group 42 percent found it hard to listen attentively to the tapes and in the self-paced group 40 percent found it hard to listen to the tapes attentively.

Statement: Having the filmstrip on Television was better than having the filmstrip.

Group	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Total Responses
II	4	0	2	5	10	21
IV	3	0	4	3	10	20

The above data indicates that 47 percent of the forced-paced students agreed that television was better than viewing a filmstrip. 50 percent of the self-paced students agreed. If the two groups are combined in the areas of "slightly agree" and "agree" 68 percent of the students agree that television was better.

Statement: I would rather have had a lecture hour by a live instructor.

In response to this question, 80 percent of the forced-paced group disagreed with the statement. Apparently

they did not feel that face to face instruction would be superior to the television method of presenting the program.

Group	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Total Responses
II	17	2	1	1	0	21
IV	9	3	2	0	4	18

Statement: The text manual was essential for me and without it wouldn't have gotten a thing from the program.

Group	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Total Responses
II	1	3	5	7	5	21
IV	3	3	5	1	8	20

Although 23 percent of the forced-paced and 40 percent of the self-paced students agreed that the manual was necessary, there was a large percentage who were neutral or disagreed that the manual was necessary. The results of this question may not be conclusive since all students had a manual and had no basis on which to judge the question.

Statement: My overall evaluation of the course.

Group	Disliked	Slightly Displeased	Neutral	Slightly Pleased	Pleased	Responses
II	1	1	8	9	2	21
IV	1	1	8	8	2	20

52 percent of the forced-paced and 50 percent of the self-

paced students were pleased or slightly pleased with the course. It appears that approximately 40 percent of the students felt that the course was acceptable since they were neutral.

Compressed Rate:

Statement: I would like to see more modules in Compressed Rate audio-visual form.

Group	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Total Responses
I	0	6	3	2	10	21
III	3	4	5	4	4	20

Groups I and III were engaged in the compressed rate program. Of the 21 responding in the forced-paced group 47 percent felt that they would like to see more compressed programs used. In group III (self-paced) only 20 percent wished to see more compressed programs used. 25 percent of the students in group III did not agree or disagree.

Statement: The lessons were hard to understand because they were too fast.

Group	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Total Responses
I	8	4	3	5	1	21
III	4	4	4	6	2	20

Apparently the 30 percent compression rate was not too fast

for the forced-paced group since 38 percent felt that the tapes were not hard to understand while 30 percent of the self-paced group felt they were hard to understand. A very small percentage felt the tapes were too fast.

Statement: I had a lot more free time to study as a result of the compressed rate.

Group	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Total Responses
I	1	1	1	4	14	21
III	4	0	2	6	7	19

One of the by-products of the use of compressed speech is that some time is left over when the program is complete. This statement was included to see if the student realized he had time left for further study. Group I had 66 percent who felt they had free time as a result of the compressed rate. In Group III, 20 percent felt they did not have any extra free time and 36 percent agreed that they did have extra free time.

Statement: I feel the compressed rate demanded more of my attention and as a result I learned more.

Group	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Total Responses
I	4	3	4	0	10	21
III	4	2	5	5	4	20

It may be that compressed speech causes a student to listen more attentively since the words and phrases are more rapid than the students are subjected to normally. In the forced paced group, 47 percent of the students had the opinion that the compressed speech demanded their attention which may have aided in a higher achievement level. In the self-paced group the responses were almost evenly divided.

Statement: It would have been more valuable to me if I had control over the rate of compression.

Group	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Total Responses
I	9	5	4	2	1	21
III	3	5	3	3	6	20

Most of the forced-paced group felt that they did not need to have control of the compression rate while the self-paced group was apparently split in their decision.

Statement: My overall evaluation of the course.

Group	Disliked	Slightly Displeased	Neutral	Slightly Pleased	Pleased	Total Responses
I	1	0	3	8	9	21
III	0	2	7	10	1	20

The overall evaluation of the automated program was generally favorable. If the groups are combined, 68 percent of the students were slightly pleased or pleased with the automated program.

Summary of the Pearson r Correlations

The correlations between the School-College Aptitude Test, the Nelson-Denny Reading Test, the grade point averages and the achievement scores on the automated program final examination do not show strong relationships consistantly and prediction from the correlation combinations may entail some risk. It appears that the grade point average is the best indication of achievement success on the final examination since the correlations were significant in three out of four of the groups ($p < .05$).

In the other relationships, the Nelson-Denny versus the final achievement score, the School College Aptitude Test versus the final achievement score, the correlations were inconsistant.

Summary of the Research Findings

> Hypothesis One - There is no significant difference between the mean scores of students who are forced-paced through an automated program and those who are self-paced through an automated program.

The ANOVA used to test hypothesis one indicated no significant difference between the achievement mean scores of students who were forced-paced and those who were self-paced ($F < 1$). Hypothesis one was retained.

> Hypothesis Two - There is no significant difference between the mean scores of students who receive the compressed version of the automated program and those who receive the normal rate version.

Hypothesis two was tested with the same 2 x 2

analysis of variance. The results indicated a significant difference between the rate of presentation in favor of the compressed rate ($p < .20$). Students who used the compressed rate version of the automated program achieved at a higher level than the students who used the normal rate program. Hypothesis Two was rejected.

> Hypothesis Three - There is no significant interaction between the mode of presentation and the rate of presentation of the program.

Hypothesis Three was retained. The same 2 x 2 analysis of variance indicated no significant interaction between the mode of presentation and the rate of presentation ($F < 1$).

> Hypothesis Four - There is no significant difference between the achievement of students classified as high achievers and those who are classified as low achievers when the pacing is controlled and the program is controlled.

Eight 2 x 2 analyses of variance were computed to test Hypothesis Four. The analyses involved high and low achievers on the final examination, the School-College Aptitude Test, and the Nelson-Denny Reading Test. The results are as follows:

1. The 2 x 2 ANOVA used to test for significant differences between the achievement scores of students who had high grade point averages and those who had low grade point averages in a forced-paced mode of presentation indicated a significant difference between the high

grade point average and the low grade point average student achievement scores ($p < .05$) and a significant difference between the rates of presentation ($p < .10$). Both the high and low achievers achieved at a higher level when they used the compressed version of the automated program. The high achievers achieved at a higher level than the low achievers at both rates of presentation. The interaction of the two variables was not significant ($F < 1$).

2. The 2 x 2 ANOVA used to test for significant differences between the achievement scores of students who had high grade point averages and those who had low grade point averages in a self-paced mode of presentation indicated a significant difference between the high grade point average and the low grade point average student achievement scores ($p < .005$) but did not indicate a significant difference between the rates of presentation ($F < 1$). Students who used the normal rate version did almost as well as students who used the compressed rate version. The interaction of the two variables was not significant ($F < 1$).

3. A 2 x 2 ANOVA used to test for a significant difference between the achievement scores due to the mode of presentation and the rate of presentation for students with high grade point averages indicated a significant difference in the modes of presentation ($p < .20$) in favor

of the self-paced version but no significant difference due to the rate of presentation ($F < 1$). High grade point average students achieve at a higher level when self-paced but the rate of presentation is of no consequence. The interaction effect was insignificant ($F < 1$).

4. A 2 x 2 ANOVA used to test for a significant difference between the achievement scores due to the mode of presentation and the rate of presentation for students with low grade point averages indicated a significant difference due to the rate of presentation ($p < .20$) but failed to indicate a significant difference due to the mode of presentation ($F < 1$). Low grade point average students achieve at a higher level when forced-paced at the compressed rate. There was not a significant interaction ($F < 1$).

5. A 2 x 2 ANOVA used to test for significant differences between the achievement scores of students who scored high on the School-College Aptitude Test and those who scored low on the School-College Aptitude Test in the forced-paced mode of presentation revealed a significant difference between the high and the low achievement scores ($p < .01$) and a significant difference between the rate of presentation ($p < .20$). Although the ANOVA indicated an interaction effect, it was not significant at $p < .20$. Students who were forced-paced and had a high SCAT score did significantly better at the compressed

rate and scored significantly higher than the students with a low SCAT score on the achievement test.

6. A 2 x 2 ANOVA used to test for significant difference between the achievement scores of students who scored high on the SCAT and those who scored low on the SCAT in the self-paced mode of presentation revealed a significant difference between the high and the low SCAT achievement scores ($p < .05$) but not a significant difference between the rates of presentation ($F < 1$). Students who were self-paced and had a high SCAT score achieved as well at the compressed rate as they did at the normal rate and scored significantly higher than the students with a low SCAT score. There were no interaction effects ($F < 1$).

7. A 2 x 2 ANOVA used to test for significant differences between the achievement scores of students scoring high and low on the Nelson-Denny Reading Comprehension Test in the forced-paced mode of presentation and the compressed and normal rate of presentation indicated a significant difference in favor of the high achiever between the achievement scores of the high and low achievers on the comprehension test ($p < .025$). There was not a significant difference between the rates of presentation ($F < 1$). There were no significant interaction effects ($F < 1$).

8. A 2 x 2 ANOVA was used to test for significant differences between the achievement scores of students scoring high and low on the Nelson-Denny Reading Comprehen-

sion Test in the self-paced mode of presentation and the compressed and normal rate of presentation indicated a significant difference in favor of the high achiever between the achievement scores of the high and low achievers on the comprehension test ($p < .05$). There was not a significant difference between the rates of presentation ($F < 1$) and there were no interaction effects ($F < 1$).

Hypothesis four was rejected in every case regarding the achievement level of the students designated as high achievers. The high achievers consistantly achieved at a higher level than the low achievers. (The high and low achiever designation was based on the SCAT scores, the grade point averages and the Nelson-Denny Reading Test scores). However, the student achievement was affected by the rate of presentation and the mode of presentation as follows:

1. High and low achievers based on grade point averages achieved higher at the compressed rate in the forced-paced mode of presentation.

2. High and low achievers based on grade point averages achieved about the same at either rate of presentation in the self-paced mode of presentation.

3. High achievers based on grade point averages achieved at a higher level when self-paced at either rate of presentation.

4. Low achievers based on grade point averages

achieved at the same level in either mode of presentation but achieved higher at the compressed rate.

5. High and low achievers based on SCAT scores achieved at a higher level at the compressed rate when forced-paced.

6. High and low achievers based on SCAT scores achieved at the same level at either rate when self-paced.

7. High and low achievers based on the Nelson-Denny Reading comprehension test achieved at the same level at either rate when forced-paced.

8. High and low achievers based on the Nelson-Denny Reading comprehension test achieved at the same level at either rate when self-paced.

> Hypothesis Five - There is no significant difference between the achievement of male students who receive the compressed version of the automated program in both modes of presentation and those who receive the normal rate version in both modes of presentation.

A 2 x 2 ANOVA was used to test for significant differences among the achievement scores of male students in both rates of presentation (compressed and normal speech rates) and both modes of presentation (forced-paced and self-paced). The ANOVA indicated a significant difference between the rates of presentation ($p < .025$) in favor of the compressed rate, but no significant difference between the mode of presentation ($F < 1$). The interaction effect between the rates of presentation and the mode of

presentation was significant at $p < .025$. Male students achieve at a higher level when they received the compressed version of the automated program and the mode of presentation had little effect. However, male students who were forced-paced with the compressed version had a significant increase in their achievement level. The portion of hypothesis five regarding the effect of the mode of presentation upon the achievement is retained and the portion of hypothesis five regarding the effect of the rate of presentation is rejected.

> Hypothesis Six - There is no significant difference between the achievement of female students who receive the compressed rate version of the automated program in both modes of presentation and those who receive the normal rate version in both modes of presentation.

A 2 x 2 ANOVA was used to test for significant differences among the achievement scores of female students in both rates of presentation and both modes of presentation. The ANOVA indicated a significant interaction between the mode of presentation and the rate of presentation ($p < .10$). There was no significant difference between the modes of presentation and the rates of presentation ($F < 1$). The achievement level of the female students was not significantly different when they used either the compressed rate or the normal rate version of the automated program and when they were in either the forced-paced or self-paced groups. However, the ANOVA indicated that the female

students achieve at a higher level when self-paced at the compressed rate. Hypothesis six was retained.

Note: This is contrasted with the male students who achieved at a higher level when forced-paced at the compressed rate.

Hypothesis Seven - There is no significant difference between the achievement of male and the achievement of female students who receive the compressed version of the automated program and those who receive the normal rate version of the automated program in the forced-paced mode.

A 2 x 2 ANOVA was used to test for significant differences between the achievement scores of male and female students in the forced-paced mode of presentation using both compressed and normal rates of presentation. The ANOVA indicated that there was no significant difference in the male and female achievement scores ($F < 1$), however, there was a significant difference in the rates of presentation ($p < .05$). The interaction effect between the sexes and the rate of presentation was significant ($p < .001$). Male students achieved at a higher level when they used the compressed version and were forced-paced while female students achieved at a higher level when they used the normal version and were forced-paced. Hypothesis seven was retained for that portion relating to a difference between the male and female achievement scores, however, hypothesis seven was rejected for that portion relating to the difference in achievement scores due to the rate of presentation.

> Hypothesis Eight - There is no significant difference between the achievement of male and the achievement of female students who receive the compressed version of the automated program and those who receive the normal rate version of the automated program in the self-paced mode.

A final 2 x 2 ANOVA was used to test for significant differences between the achievement scores of male and female students in the self-paced mode of presentation. The ANOVA indicated that there was no significant differences between the mode of presentation, the rate of presentation, or the interaction effects. In the self-paced mode of presentation, both male and female students achieve at the same level in both the compressed rate and the normal rate versions of the automated program.

Summary of the Time Saved

The time used by the forced-paced compressed group was 30.10 percent less than the time used by the forced-paced normal rate group. The self-paced compressed group used 24.8 percent less time than the self-paced normal group. The forced-paced compressed group used 39.2 percent less time than the self-paced normal group.

CHAPTER V

SUMMARY, RECOMMENDATIONS AND IMPLICATIONS

Statement of the Problem

The problem of this study was to answer this question: Will students who are forced-paced through an automated program recorded at a compressed rate achieve at a higher level than students who are self-paced through an automated program at the normal rate? The vehicle used to investigate this effect was an automated media filmstrip-sound program recorded on 3/4 inch video tape. The audio on one set of video tapes was recorded at a normal speech rate and the other set was recorded at a compressed speech rate.

Procedure

Four groups of students were randomly assigned from a population enrolled in the Fall 1973 school term in the course 4001 Competency in Instructional Media. The data was collected from a midterm and a final examination combined to form an evaluation of sixteen video taped media lessons. The sixteen lessons were recorded on 3/4 inch video tape cassettes. One version had a sound track compressed to 70 per cent of its normal length, and the other version was recorded at the normal rate of speech. The word rate of the compressed version was 211 words per minute and the word rate of the original normal recorded version was

150 words per minute.

Two of the subgroups in the forced-paced group were rigidly controlled by an administrator who delivered the sixteen videotaped lessons via a television video player and a 23-inch television monitor. The tapes were played only one time to a subgroup who listened through individual headsets and took notes in the manual designed especially for the automated course. One subgroup in the forced-paced group listened and watched a compressed rate sound track and television pictorials and the other subgroup listened and watched a normal rate sound track and television pictorials.

Subgroup I - Forced-Paced - Compressed rate

Subgroup II - Forced-paced - Normal rate

The remaining two subgroups were designated self-paced and were allowed to use a television module consisting of a video playback instrument, a television monitor, and a headset. The student was free to schedule the module at a time convenient to him and operate the video player himself. The student could replay or stop the video tape as many times as he wished or listen to it without interruption. Each student had a study manual. One subgroup listened and watched the video tapes recorded with a compressed rate sound track and the other subgroup listened and watched the video tapes recorded with a normal rate sound track.

Subgroup III - Self-paced - Compressed

Subgroup IV - Self-paced - Normal

A machinery laboratory was also scheduled where the student had the opportunity to get hands-on experience with media and materials. All four subgroups took part in the machinery competency laboratory. A laboratory assistant was in attendance to assist with machinery competence.

Testing

The students' prior records were examined to obtain their present grade point averages and their School-College Aptitude Test (SCAT) scores. During the first week of the 4001 Media Competency course, all students were administered the Nelson-Denny Reading Test from which their comprehension and reading rates were established. These data were used to verify the normal distribution of the groups.

The mid-term examination was administered to all four subgroups and added to the final examination given at the end of the program to form the evaluation instrument used in this study. The final evaluation is included in Appendix F.

Research Design

The achievement scores of the students were formed into a 2 x 2 factorial analysis of variance. The main

effect of Mode of Presentation and the main effect of Rate of Presentation were examined by computing the ANOVA and obtaining an F-ratio. The design paradigm for the ANOVA is reviewed below:

Mode of Presentation	Rate of Presentation: Compressed	Rate of Presentation: Normal
Forced-Paced		
Self-Paced		

Correlations between the various test results were also computed using the Pearson Product-Moment procedure.

A summary of the findings based upon the statistical treatment of the data obtained from the student achievement scores on the final examination are given in the next section.

Results

The results of the statistical analysis using the 2 x 2 factorial analysis of variance paradigm are as follows:

1. In either the normal or compressed rate version of the automated program, the students' achievement level is not significantly affected by the mode of presentation.

2. In either the self-paced or forced-paced version of the automated program, the students' achievement level is significantly affected by the rate of presentation in favor of the compressed rate.

3. In both the self-paced and forced-paced version of the automated program, students with high grade point averages scored significantly higher than students with low grade point averages. The students with low grade point averages achieved at a higher level at the compressed rate when forced-paced but when self-paced the rate of presentation did not have a significant effect. The rate of presentation does not significantly affect the achievement of students with high grade point average.

4. Students with high grade point averages scored at a higher level when self-paced and the rate of presentation did not significantly affect the achievement level. Students with low grade point averages scored at a higher level with the compressed rate version and the mode of presentation did not significantly affect the achievement level.

7. Students who have obtained a high SCAT score achieve at a higher level with the compressed form of the automated program in the forced-paced mode of presentation, however, in the self-paced mode of presentation the rate of presentation does not significantly affect the achievement level.

8. Students who have obtained a high comprehension score on the Nelson-Denny Reading Test achieve at a higher level than students who score low on the comprehension test in either the self-paced or the forced-paced mode of presentation. The rate of presentation does not significantly affect the achievement level.

9. Male students achieve at a higher level when they receive the automated program at the compressed rate and when they are forced-paced and female students achieve at a higher level when self-paced at the compressed rate and forced-paced at the normal rate. There is not a significant difference between the achievement levels of male and female students in the self-paced mode of presentation.

Implications of the Research

From the findings developed from the statistical analysis of the data, the following implications are formulated:

1. Students can learn from audio filmstrip programs transcribed to the television format.

2. Students can achieve at a higher level when the audio program format is compressed to 70 percent of its normal length (30 percent compression).

3. Generally students can learn as well being forced-paced through a program as they can if they are allowed to pace themselves.

4. Students with high academic standing based on grade point average, SCAT scores, and Nelson-Denny Comprehension scores achieve consistantly higher on examination than those students with low academic standing based on the same criteria. Giving these tests prior to administration of a program would give a good indication of how well the student would achieve.

5. Since students with high academic standing achieve at a higher level when self-paced in either rate of presentation, the compressed rate programs would save time with little or no loss in content.

6. Since students with low academic standing achieve at a higher level at the compressed rate in either mode of presentation, the compressed programs in the forced-paced mode would save time and may raise the achievement level of the low academic student.

7. Schools with more males than females in classes should consider using compressed programs in a forced-paced mode, but if the classes are mostly female, the compressed programs should be administered in the self-paced

mode.

8. Male and Female students score about the same on achievement tests. However, male students tend to score higher at the compressed rate when forced-paced and females tend to score higher at the normal rate when forced-paced.

9. When male and female students are self-paced they all score approximately the same and the mode of presentation and the rate of presentation affects the sexes in the same way. Co-educational schools which have self-paced programs should consider using compressed speech.

10. Students generally will score as high or higher at the compressed rate. There is an indication that at the 30 percent level of compression, the students' achievement is not impared and saves time.

11. Forced-pacing of students does not impair the achievement level and does save time when the audio program is compressed at the 30 percent level.

12. Using the television tape recordings for the filmstrip slide automated program did not appear to cause any technical problems. In fact, the students actually preferred preferred the television mode of presentation over face-to face instruction. Television programming is automatic, quiet in operation, not dependent upon frequency tones to change the frames, and technically trouble free to operate.

13. Television recordings can be used very

effectively over closed-circuit television cables to classrooms remote from the point of origin. If institutions use this method of transmission, large groups of students or many small groups in different places can be taught simultaneously at a faster rate than normal.

14. The use of compressed speech, because it does save time, supports the effective use of institutional facilities by releasing the equipment early and providing more equipment usage in the same time periods.

15. The use of television pictorials transcribed from filmstrip or slide-sound programs provides a means of producing many copies of automated programs to form student modules for individual, small group, or large group viewing. It is advisable however, to obtain permission to duplicate copyrighted material.

Recommendations

Based on the results of the research in this study, the following recommendations for implementation are submitted:

1. Institutions having media programs in the filmstrip-sound or slide-sound format should consider transcribing the media program to video tape. This consolidates the package into an automatic module and the students are free to concentrate on learning instead of equipment manipulation. It is advisable to obtain permission to duplicate if the program is copyrighted.

2. Institutions having audio tapes recorded at the normal speech rate should consider transcribing the tapes to the compressed form. The compressed form saves time and the student achievement level is not significantly impaired.

3. Institutions having classes involved in learning material via audio tapes and filmstrip-sound methods should consider compressing the audio form and force-pacing the students through the material in a small group setting.

Recommendations for Further Study

This study was limited to students who were admitted to teacher education. These students were representatives of a special group of students within the college student population. They all had a grade point average of above 2.00, they all were seasoned college students at the Junior and Senior level, and they all had the common goal of becoming a teacher. Research such as this study represents should be conducted with:

1. Freshman students enrolled in a general education course,

2. Students who were not necessarily homogeneous in background or future goals, and

3. Students who were "special" in another category such as all artists, all scientists, all health and physical education majors, or members of ethnic groups.

Research of this kind may substantiate or refute some of the findings of this study and therefore strengthen the research implications.

In addition to the above recommendations further studies in the following areas are suggested:

1. The identification and effects of student anxiety due to high speech compression rates.

2. The effect of the length of the presentation upon the comprehension of material.

3. The effect of material difficulty versus the

maximum compression rate a student can endure before the comprehension begins to be significantly affected.

4. The effect of compressed speech on the slow learner using material designed for the slow learner (low level of difficulty and forced-paced).

5. The effect of compressed speech on the rate of forgetting over controlled intervals of time versus the effect of compressed speech on the rate of forgetting with higher rates of speech administered intermittantly between the controlled intervals.

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APPENDIX A

STUDY MATERIALS IN EDUCATIONAL MEDIA

TOPIC OUTLINE

Unit I. Historical Development of Educational Media
- A. Historical Perspective
- B. The Infancy of Audio-Visual Materials--1900-1940
- C. Growth from Necessity, The War Years--1940-1945
- D. The Post War Period--1945-1958
- E. A Period of Motivation--1958 to the Present

Unit II. Educational Basis for the Use of Educational Media
- A. Implications of Learning for Educational Media Usage
- B. Scientific vs. Traditional Points of View
- C. Verbalism vs. Direct Experiences
- D. Piaget's Stages of Development--Implications for Media
- E. Communication Barriers
- F. Media Use to Overcome Communication Barriers
- G. Research on Media Effects

Unit III. Operation and Maintenance of A/V Equipment
- A. Suggested Approach to Learning Equipment Operation
- B. Motion Picture Projectors
  1. Types and Formats
  2. Operating Principles
  3. Setting Up the Projector
  4. Threading
  5. Projection Tips
  6. Maintenance
  7. Rewind
- C. Other Media
  1. Audio Tape Recorder
  2. Filmstrip Projector

Unit IV. Motion Picture Films in Education
- A. Instructional Applications of Motion Picture Film
- B. Historical Development
- C. Innovations in Film Formats and Applications
- D. Research Basis for Film Usage
- E. Film Making Devices and Techniques
  1. Time Lapse
  2. Slow Motion
  3. Telephoto Photography
  4. Micro and Macro Cinematography
  5. Animation
  6. Use of Color
  7. Flashbacks

Unit V. Utilization of Audio-Visual Materials--The Teacher Utilizes a Motion Picture Film
- A. Analysis of Class Needs
- B. Selection of Films
- C. Previewing
- D. Decisions About Film Use
- E. Class Preparation

Unit VI. Part 1: Selection and Utilization of Still Projected Media
- A. Values of Still Projected Media
- B. Selection of Still Projected Media
- C. Utilization
- D. Types of Projected Still Media
  1. Two by Two Inch Slides and Filmstrips
  2. Micro-forms
  3. Opaque Projection
- E. Physical Characteristics and Operation of Slide and Filmstrip Projectors
- F. The Overhead Projector
- G. Tachistoscopic Devices

Unit VI. Part 2: Preparation of Still Projected Media
- A. Types of Overhead Transparencies
  1. Thermal
  2. Dry Photocopy
  3. Diazo
  4. Handmade
  5. Colorlift
- B. Pre-production Considerations
- C. General Production Principles and Practices
- D. Specific Steps Involved in Production of Each Type of Transparency
- E. Mounting Transparencies and Overlays

Unit VII. Pictorial and Other Graphic Materials
- A. Flat Pictures
  1. Selection of Prints for Classroom Use
  2. Utilization of Flat Pictures
  3. Display Techniques
  4. Storage and Filing
- B. Dry Mounting and Laminating
  1. Advantages of Dry Mount
  2. How to Use a Dry Mount Press
- C. Graphics
  1. Charts
  2. Diagrams
  3. Graphs
  4. Cartoons

Unit VIII. Clingboards, Chalkboards, Bulletin Boards, and Posters

- A. Clingboards
  - 1. Advantages and Applications
  - 2. Materials
  - 3. Utilization and Limitations
- B. Chalkboards
  - 1. Advantages and Limitations
  - 2. Materials
  - 3. Techniques for Getting the Most from the Chalkboard
- C. Bulletin Boards
  - 1. Uses of Bulletin Boards
  - 2. Planning, Designing and Developing Bulletin Boards
- D. Posters
  - 1. Characteristics of a Poster
  - 2. Uses of Posters

Unit IX. Maps, Globes and 3-D Materials

- A. Maps and Globes
  - 1. Information Available
  - 2. Advantages of Globes
  - 3. Criteria for Selection of Globes
  - 4. Advantages of Maps
  - 5. Types of Error in Maps
- B. 3-D Objects
  - 1. Models
  - 2. Mock-ups
  - 3. Dioramas
  - 4. Realia
  - 5. Principles for Utilization of 3-D Objects
  - 6. Sources of 3-D Materials

Unit X. Auditory Materials

- A. Forms of Audio Materials
- B. Tape Recordings
- C. Disc Recordings
- D. Radio
- E. Problems in the Use of Auditory Materials

Unit XI. Television in Education

- A. The Development of the Medium of Television
- B. Types of Television: Commercial, Educational and Instructional
- C. Open versus Closed Circuit
- D. Equipment for Instructional Television

Unit XII. Teaching Machines and Programmed Materials

- A. Teachers and Programs
- B. Procedures for Developing Programmed Materials
- C. Advantages and Limitations of Programmed Instruction
- D. Types of Programmed Instruction
- E. Modes of Presentation for Programmed Materials
- F. Computer Assisted Instruction

Unit XIII. Educational Media Center and Community Resources

- A. The Genesis of Educational Media Centers
- B. Functions and Structure of Media Centers
- C. Community Resources as a Learning Tool
- D. Excursions
- E. Resource Persons

APPENDIX B

CALCULATION OF WORD RATE

BASED ON RANDOM SAMPLE OF 724 WORDS FROM UNIT 12.

Normal Rate	$\frac{724 \text{ words}}{4.83 \text{ min}}$ =	149.90	words per minute
Compressed Rate	$\frac{724 \text{ words}}{3.43 \text{ min}}$	211.08	words per minute

CALCULATION OF COMPRESSION RATE

BASED ON RANDOM SAMPLE OF 724 WORDS FROM UNIT 12.

Compressed Rate	$\frac{149.90 \text{ words per minute}}{211.08 \text{ words per minute}}$ =	71.01 %[1]	

[1]The Compressed Tape was 71.01 percent of the normal length.

UNIT NORMAL AND COMPRESSED RATE

AUDIO TAPE RUNNING TIMES

Program	Normal Program	Compressed Program	Time Saved
Unit I	14.833	10.283	4.550
Unit II	26.833	18.917	7.917
Unit III	17.733	11.917	5.817
Unit IV	23.867	16.500	7.367
Unit V	10.400	7.350	3.050
Unit VI 1-1	15.000	11.333	3.667
Unit VI 1-2	21.083	14.700	6.383
Unit VI 2-1	20.983	14.600	6.383
Unit VI 2-2	16.100	11.067	5.033
Unit VII	19.833	13.833	6.000
Unit VIII	24.433	17.167	7.267
Unit IX	17.583	12.367	5.217
Unit X	6.183	4.333	1.850
Unit XI	21.083	14.667	6.417
Unit XII	22.367	15.650	6.717
Unit XIII	13.183	9.200	3.983
Total	291.499	203.883	87.617
Conversion to Hours	4:51:30	3:23:53	1:27:37

APPENDIX C

READABILITY (READING EASE)

	Number of Syllables	Sentence length
First 100 Words	161	31.33
Second 100 Words	150	21.60
Third 100 Words	171	24.50
Fourth 100 Words	191	20.66
Fifth 100 Words	169	17.75
Sixth 100 Words	168	30.00
Seventh 100 Words	176	22.50
Mean/100 words	169.43	24.04

Reading Ease (RE) = 206.835 - .846 wl - 1.015 sl

RE = 206.835 - .846 x 169.43 - 1.015 x 24.04

RE = 206.835 - 142.32 - 24.28

RE = 40.235

TABLE 1. READING EASE SCORES

Reading Ease Score	Description of Style	Type of Periodical	wl	sl
0-30	Very Difficult	Scientific	192 up	29 up
30-50	Difficult	Academic	167	25
50-60	Fairly Difficult	Quality	155	21
60-70	Standard	Digests	147	17
70-80	Fairly Easy	Slick Fiction	139	14
80-90	Easy	Pulp Fiction	131	11
90-100	Very Easy	Comics	123 down	8 down

RANDOM SELECTION FROM UNIT 12

The first teaching machine was invented by Sydney L. Pressey, who attempted to devise a machine that would present a problem to which a student would respond by pushing a button. This machine would then provide him with immediate knowledge of whether his answer was correct or incorrect, and if incorrect would allow him to try again until he shows the correct answer. It would also make a cumulative record of the students' responses which could be analyzed later, however, Pressey's machine was never accepted by educators as a practical approach to tutoring individuals. The simplest machines are actually nothing more than automated page-turners for presenting linear programs. They offer no advantages over program books and are usually considerably more inconvenient to use. Only slightly more sophisticated than the automatic page-turner are the "cheat-proof" machines. These machines differ from the first catagory by being designed in such a way the student cannot read the correct response before he makes his own response to the question. When considering the purchases of these machines you should weigh the advantage against the lower cost and greater convenience of programmed books to determine which form would be more advantageous to your particular situation. A more sophisticated teaching machine such as this one can present information by both audio and visual means. This factor makes them less dependent upon complete verbal channels of communication and extends this scope of usefulness to those people who teach

the reading skills necessary for most printed programs.

These machines are capable of discriminating between the correct and incorrect responses and of providing immediate reinforcement to the student. Many of these machines will also keep a record of the students responses so that his progress can be analyzed to determine if he is having special problems.

Very similar to programmed instruction but infinitly more sophisticated is computer assisted instruction and computer managed instruction. At the present time the cost of CAI is so high it is not practical for general school application. However, its potential for automated tutoring appears so great you should know something of its capabilities. In most CAI systems the student works at an individuals terminal and is connected with a computer.

The terminal is equipped with a typewriter keyboard by which a student responds to questions. A cathode ray tube similar to a small television screen on which printed information and simple visuals are presented and a light pen with which a student can respond to questions when pointing to words or pictures on the tube.

Recent models of this system do not use a light pen. All the student need do is touch his finger to the screen. CAI offers a more personalized type of programmed student interaction than is possible with conventional programmed instruction. The CAI system which was used for a time in

the University of Oklahoma medical school in Oklahoma City had two such devices we can use as examples. One of these study aids was a provision which allowed a student to receive additional information anytime he felt it was needed. In this system when the student desired additional information about the concept being taught he simply typed the word "help" on the terminal keyboard and the computer would immediately give him a more detailed, slower-paced explanation of the concept.

The other study aid allowed the student who was becoming confused concerning the total view of the lesson to push a button which immediately caused the computer to present a complete outline of the lesson up to that point.

As we stated earlier the cost of CAI is prohibited at the present time. Yet, if technological advances or other events should increase the economic productability of such systems there would likely become immediate concern to many of us. To further your understanding of the information presented in this unit you should consult some other sources. In the Brown, Lewis, and Harcleroad text, Audio Visual Instruction Media and Methods, page 111 to 130 deal with programmed instruction and pages 510 to 515 give more information on computer assisted instruction. This is the end of unit 12.

APPENDIX D

TELEVISION HEWS SCRIPT

December 31, 1973 - 5:30 CBS Evening News

Roger Mudd. Good evening. In Israel's largest cities and furtherest outposts about two million Israelies voted in national and local elections today. Prime Minister Golda Mier, the 75 year old Russian born grandmother, was fighting for her and her labor party's political life. The conservative challenger Menaham Begin of the Likud coalition was given at least an even chance of defeating Mrs. Mier. Tom Fenton reports from the Labor Party headquarters in Tel Aviv.

Tom Fenton. First returns at labor party headquarters indicate a record number of Israelies voted today in the most important elections since the state of Israel was founded. The outcome of the election is expected to set Israel's future course in its first real peace negotiations with the Arabs. The choice of the voters was clear. Prime Minister Golda Mier said she was willing to give up much of the occupied Arab territory in return for real peace. The opposition Likud, a right wing block, campaigned on a program of "no compromise" and said it would hold on to much of the captured lands. For the 75 year old prime minister, election day marked the end of a long and trying ordeal a campaign interrupted by the unexpected Arab attack and a post war period of bitter wrangling inside her own labor party.

Mrs. Mier emerged from the ordeal with her popularity badly damaged. Defense Minister Mosche Dyan's brilliant reputation was another casuality of the Yom Kipper war. There have been persistant rumors that he will be dropped from the labor party leadership no matter what the outcome of the votes. The campaign stragedy of Menaham Begin, the leader of the Likud was to win enough votes to form a national unity government along with the labor party. His hard-line, hawkish view, his refusal to compromise with the Arabs drew an enthusiastic response during the campaign with the country still mobilized for war. Soldiers represented a sizable block of votes, enough to swing a close election.

Despite a maximum alert ordered in the wake of reported Syrian and Egyptian troop movements and continued sporatic shooting on both fronts, soldiers voted even at the most forward positions inside Syria. Correspondent Dean Raylis talked to some of the front line voters and found that peace with security was formost on their minds.

Interviews . . . . .

More than 5% of the voters were Arabs. They traditionally split their votes between labor and Israel's two small communist parties. The key issue in the campaign was the Geneva Peace conference. It overshadowed all other questions including such basic issues as inflation and high taxes for which the labor party has set something of a world record. In casting

their ballots, Isralies, basically, were voting for "peace through compromise" as advocated by Mrs. Mier or "security through toughness" as advocated by Begin. Tom Fenton, CBS News, Tel Aviv.

Roger Mudd. As motorists scrambled today to fill up their gas tanks for the holiday, energy officials in Washington had some discouraging predictions for the New Year. They said that gasoline and home heating oil prices may go up as much as ten cents a gallon by March first.

Briton began a three day work week today to survive its worst economic crises since Warld War II. More than six hundred thousand workers were laid off. The shortened work week is designed to save energy supplies for essentials such as hospitals and schools. There was some good news for the British, the Scotch whiskey industry and the pubs were exempted.

During the past twenty-four hours in Southeast Asia forty six South Vietnamese and Communist soldiers were killed in fighting. But for the first time in a decade the New Year finds no American soldiers involved. There are still Americans missing, however. A team of CBS News correspondents report tonight on the Americans missing in action and their families.

Eric Sevareid. A lot of three-pound books are going to be written about the year 1973. There is a temptation to compare it to 1945 when old empires collapsed, new ones took form, famous leaders went under, the world power balance

radically shifted, and new styles in daily life set in all over the world. There is a tinge of war-time feeling in domestic atmosphere as '73 ends because of the fuel emergency. Yet this has been the first year in a decade in which Americans were not shooting and getting shot at somewhere in the world. A very long time ago one of the founding fathers said that power always thinks it has a great soul and vast views beyond the comprehension of the weak. '73 taught us a lot about power, what a very few men can do with it and what it can do to them. We have seen abuse of power turn a law and order administration into one of the most lawless and disorderly we have ever known, very nearly destroying the Presidency in the process as it collided not only with natural political enemies and much of the press but with the intellectual community that Congress acourts and much of the bureaucracy. We saw what gave promise to becoming a new political majority disentegrate, before it could be consolidated. And we saw in consequence a resurgence of traditional values of public yearning for the simple virtues of honesty, plain speaking, private rights, due process, and civility in political life.

We saw a few men five thousand miles away in the oil producing states turn a valve and exert an almost life or death power over the modern complicated societies of the earth. As one consequence, we saw that the giant trap into which the automobile has led us was sprung at last. This too,

has produced a resurgence of a newrly forgotten cast of mind. Old, derided words emerged from the limbo of collected memory and seen brand new and full of meaning. Moderation, frugality, patience, and self-sacrifice. "small" suddenly had more pertinence than "big", "slow" more than "fast". There is no certainty of the year-end that the American people can make the deep-seated adjustment required without tearing the bonds of civil order. But quite a lot of evidence suggests that we can and will.

A British writer and scholar, Henry Fairley, long in this country, publishes a reminder and advisory today worth repeating. "Those who have a special responsibility for carrying on the public conversation of the country," he says, "need to gaze reflectively on the American people, and learn from their remarkable steadiness under an almost ceaseless succession of provocations."

TELEVISION NEWS SCRIPT

January 11, 1974 - 5:30 CBS Evening News

Walter Cronkite. Good evening. A high administration official said today that the nations storage tanks for home heating oil are virtually full, about topped out was the phrase used by Charles Owens of the Federal Energy Office. But the FEO warned that a prolonged severe cold wave would alter the picture within weeks and that the fuel as it burned it would have to be replaced from domestic sources rather than foreign and under the allocation program. However, there are indications that some of the mideastern oil is leaking through the Arab embargo, how much we don't know and probably won't. Commerce Secretary Dent says that government reports will show the total amount of oil imports but not the source, and he conceded that this secrecy is to encourge continued secret leakage of Arab oil. It may be partly because of a general national climate of disbelief in everything but partly because of conflicting information. But many Americans question the truth of the oil shortage. And that questioning has been apparent in a crescendo of criticism of the big oil companies.

Two senate panels chaired by Henry Jackson already have been looking into the oil problem. And next week a house committee is returning early to Washington to conduct its own three-day hearing. Jackson himself has called the heads of

major oil firms to testify on January 21, the day Congress reconvenes, and to bring facts and figures with them. In Everett, Washington today, Jackson told Richard Wagner about it.

Interview with Richard Wagner . . . .

It was only yesterday that the administration set in motion a plan to periodically examine big oils books and a reliance on the figures the industry supplied government. In the past the data has come from the American Petroleum Institute and Robert Shackney reports on the latest API figures issued just this week.

APPENDIX E

GROUP PACED

REVISED - PROGRAMMED INSTRUCTION SCHEDULE

Name_____Group number____

Laboratory Day_____

First Week:
Day 1 - Orientation and Testing
Day 2 - Compressed Speech Orientation
Laboratory - Nelson-Denny Test

	SPEED		
Second Week:	Normal		Compressed
Day 1 - Unit I	14:50		10:17
Day 2 - Unit II	26:50		- -
Laboratory Unit II	- -		18:55
Third Week:			
Day 1 - Unit III	17:44		11:55
Day 2 - Unit IV	- -		16:30
Laboratory Unit IV	23:52		- -
Fourth Week:			
Day 1 - Unit V	10:24		7:21
Day 2 - Unit VI 1-1	15:00		11:20
Laboratory Unit VI 1-2	21:05		14:42
Unit VI 2-1	20:59		14:36
Fifth Week:			
Day 1 - Unit VI 2-2	16:06		11:04
Day 2 - Unit VII	19:50		13:50
Laboratory Unit VIII	24:26		17:10
Sixth Week:			
Day 1 - Unit VIII	- -	MID-TERM	- -
Day 2 - Unit IX	17:35		12:22
Laboratory Unit X XI	6:11 21:05		4:20 14:40
Seventh Week:			
Day 1 - Unit XII	22:22		15:39
Day 2 - Unit III	13:11		9:12
Laboratory FINAL EXAMINATION	- -		- -

AUTOMATED AUDIO-VISUAL COMPETENCY

TIME SHEET

UNIT NUMBER_____

NAME_____GROUP_____

DATE_____ TIME OF DAY_____

RECORDER NUMBER_____

FINISH TIME_____

START TIME_____

TOTAL TIME _____

SIGNATURE OF STUDENT_____LABORATORY ___

SIGNATURE OF LABORATORY ASSISTANT_____

APPENDIX F

COMPETENCY IN INSTRUCTIONAL MEDIA 4001

MID-TERM

INSTRUCTIONS: Select the Best response.

1. Which company was primarily responsible for the development of the filmstrip as an educational tool?
   a. Bell and Howell
   b. Kodak
   c. Herman DeVry
   d. Society for Visual Education

2. Which historical event was most responsible for creating an interest in research and development of instructional aids?
   a. World War I
   b. World War II
   c. The 1929 depression
   d. modular scheduling

3. The historical event primarily responsible for the establishment of the National Defense Education Act in 1958 was
   a. the Korean War
   b. the Cold War
   c. placement of Sputnik in orbit
   d. Nuclear testing

4. A post-war technological development that orignated from military instructional practices was
   a. the diorama
   b. sound filmstrips
   c. electronic language laboratories
   d. models

5. A modern instructional device greatly improved since World War II is the
   a. model
   b. mock-up
   c. graph
   d. overhead projector

6. Memorization and drill is most characteristic of which of the following learning theories?
   a. mental discipline
   b. associationistic
   c. experimental
   d. Gestalt

7. Which practice implies a scientific approach to instruction?
   a. exploration
   b. identification
   c. problem solving
   d. all of the above

8. Which part of the communication model is most closely associated with encoding messages?
   a. sender
   b. channel
   c. receiver
   d. none of these

9. When the receiver gives the sender an indication of the success of the communication, this response is called
   a. symbols
   b. channels
   c. reinforcement
   d. feedback

10. Which of the following is <u>not</u> one of the types of learning described by Robert Gagne
    a. problem solving
    b. concrete operational thinking
    c. multiple discrimination
    d. chaining

11. If the word "seahorse" causes a child to visualize a horse, he is experiencing
    a. daydreaming
    b. feedback
    c. referent confusion
    d. imperception

12. Which of Piaget's learning stages is characterized by individuals who are able to visualize highly abstract concepts?
    a. pre-operational
    b. post-operational
    c. formal operational
    d. concrete operational

13. Which communication channel is more appropriate for an instructional task that requires an intermittent return to material previously covered?
    a. oral (audio-tape)
    b. oral (face-to-face)
    c. print
    d. visual-verbal (slide-tape)

14. Multi-channel presentations are most effectively used when
    a. the channels are properly integrated
    b. the concept to be learned is highly abstract
    c. the level of maturity of the learner is low
    d. all of the above

15. Lenses should always be cleaned with
    a. a soft cloth
    b. carbon tetrachloride
    c. lint-free lens paper
    d. lint-free chamois

16. Which of the following affects the synchronization between the sound and picture on a sound motion picture
    a. exciter lamp
    b. tone control
    c. lower loop
    d. sound drum

17. Which motion picture film size is most commonly used in education?
    a. 8 mm
    b. 16 mm
    c. 35 mm
    d. 70 mm

18. At what speed are silent 16 mm films projected?
    a. 8 frames per second
    b. 16 frames per second
    c. 26 frames per second
    d. 32 frames per second

19. Tape-recording erase automatically when?
    a. rewinding
    b. recording
    c. playing
    d. in fast forward

20. The most suitable method for erasing tape quickly is by
    a. an alcohol solution
    b. running through the recorder on fast forward
    c. an electromagnetic bulk eraser
    d. all of these

21. Which of the following is the most suitable instrument for removing hard deposits from the pressure plate of a projector?
    a. a pocket knife
    b. a wire brush
    c. a wooden toothpick
    d. a straightened paperclip

22. According to research, note-taking during films is likely to be
    a. detrimental
    b. beneficial
    c. of no consequence either way
    d. noen of these

23. Which of these is an advantage of super 8 mm over 16 mm?
    a. better color film
    b. larger picture area
    c. quieter operation
    d. more economical

24. Which of these motion picture techniques makes action which occures too slowly for observation more easily observed?
    a. time-lapsed
    b. flash-back
    c. slow motion
    d. animation

25. Which of these motion picture techniques is used to represent a return to an earlier time?
    a. time-lapsed
    b. flash-back
    c. slow motion
    d. animation

26. Which of the following is not a good practice in the utilization of instructional films?
    a. showing only part of a film
    b. using a film as an intorduction to other activities
    c. leaving the lights on to facilitate note-taking
    d. all of these

27. Which item represents the historical event that had the greatest effect on the use of motion picture films as an instructional tool?
    a. National Secondary School Act of 1965
    b. National Defense Education Act of 1950
    c. World War II
    d. Sputnik

28. The inventor of the flexible film base was?
    a. Thomas Edison
    b. Varney Arnspiger
    c. Oleg Kodak
    d. George Eastman

29. Which is the most appropriate question a teacher should consider in determining whether or not a motion picture film is the correct mediaum to use for teaching a particular concept
    a. is the film available
    b. is the film interesting
    c. does the concept require motion
    d. is the film expensive

30. A major advantage of rear screen projection is?
    a. the wide viewing angle
    b. it is conducive to note-taking
    c. it reduced the need for room darkening
    d. the use of mirrors

31. Which of these may be used to clinch a film presentation?
    a. class discussion of the film
    b. an oral quiz
    c. written reports from other sources on the film's subject
    d. all of the above

32. A teacher must be knowledgable in several areas to effectively utilize audiovisual materials. Which item best represents an area in which the teacher should have a basic understanding?
    a. a variety of instructional methods
    b. availability of educational media
    c. the concepts of being taught
    d. all of the above

33. Although all are transparencies in the broad sense, which of these sizes is most often referred to as a transparency?
    a. 2 x 2
    b. 2¼ x 2¼
    c. 3¼ x 4
    d. 10 x 10

34. A 10 x 10 inch transparency is often referred to as
    a. a super slide
    b. a hand-made transparency
    c. an overhead transparency
    d. a lantern slide

35. Which of these allows group viewing of microscope slides?
    a. micro-fiche
    b. micro-cards
    c. micro-film
    d. micro-projection

36. Which piece of equipment is most often used to project single-frame (or half-frame) transparent images?
    a. Carousel projector
    b. Overhead projector
    c. Film-strip projector
    d. Micro-projector

37. Transparent material which uses hinges to allow for progressive presentation is commonly called:
    a. progressive disclosure
    b. a hinged transparency
    c. an overlay transparency
    d. a multi-media transparency

38. Which item represents an advantage of 2 x 2 slides?
    a. they have a larger format than filmstrips
    b. they are more easily stored than filmstrips
    c. they are less expensive than filmstrips
    d. they are easily produced by teachers

39. Which item represents the best medium for sequential rearrangement?
    a. filmstrips
    b. 2 x 2 slides
    c. motion pictures
    d. sound filmstrips

40. A disadvantage of 35 mm filmstrips is
    a. they are too expensive
    b. they are easily lost
    c. they are easily damaged
    d. all of the above

41. Small film formats which contain large amounts of information are generally called
    a. microforms
    b. microscope slides
    c. micro-plates
    d. condensed slides

42. A practice commonly associated with the scientific approach to instruction is
    a. one-way communication
    b. teacher centered
    c. verbal communication
    d. reinforcement

43. Which part of the communication model is most closely associated with decoding messages?
    a. sender
    b. channel
    c. receiver
    d. none of these

44. "The sender can then give approval, corrections, or additional information." This is called
    a. Symbols
    b. channels
    c. reinforcement
    d. feedback

45. Which psychological barrier is caused by the learner using a faulty frame of reference?
    a. physical discomfort
    b. excessive verbalism
    c. daydreaming
    d. referent confusion

46. Which of these barriers to communication is often a product of the others listed?
    a. physical discomfort
    b. excessive verbalism
    c. daydreaming
    d. none of these

47. Which of Piaget's learning stages is characterized by individuals who can understand observed processes yet lack the ability to understand the same process when related through more abstract symbols?
    a. pre-operational
    b. concrete operational
    c. formal operational
    d. pre-formal operational

48. Which communication channel is more appropriate for an instructional task that requires overt reinforcement and feedback to clarify understanding.
    a. verbal (audio-tape)
    b. visual verbal (instructional television)
    c. verbal (programmed instruction)
    d. verbal (face to face)

49. Which of the following functions solely as a shock absorber on a motion picture projector?
    a. feed sprocket
    b. upper loop
    c. pressure plate
    d. lower loop

50. When referring to motion picture film 16 mm films refers to the
    a. speed
    b. width
    c. length of the film
    d. thickness of the film

51. At what speed are sound 16 mm films projected?
    a. 8 frames per second
    b. 16 frames per second
    c. 24 frames per second
    d. 32 frames per second

52. Which tape recording speed is more suited for recording music?
    a. 1 7/8
    b. 3 3/4
    c. 7 1/2
    d. no difference

53. Which of the following is the most suitable instrument for cleaning dust and lint from the aperture?
    a. a wooden toothpick
    b. pipe cleaner
    c. pocket knife
    d. tweezers

54. Which would you not check if a projector fails to produce a picture?
    a. projection lamp
    b. exciter lamp
    c. power cord
    d. classroom circuit breaker

55. According to research the use of color in film
    a. is more beneficial
    b. is necessary to most concepts
    c. aids special understanding
    d. none of these

56. Which of these factors contributes to super 8 films being significant improvement over regular 8 mm?
    a. better film emulsion
    b. larger picture area
    c. quieter operation
    d. more economical

57. Which of these motion picture techniques make action that occurs too quickly for observation more easily observed?
    a. time-lapse
    b. flash-back
    c. slow motion
    d. animation

58. Which of these motion picture techniques can be used to visualize an invisible process?
    a. time-lapse
    b. slow-motion
    c. flash-back
    d. animation

59. Which of these techniques is used to make extremely small objects more visible?
    a. animation
    b. tele-photo photography
    c. micro-photography
    d. slow-motion

60. The man who invented the kineoscope was
    a. George Eastman
    b. Thomas Edison
    c. Varney Arnspiger
    d. none of these

61. The first feature length sound motion picture was
    a. The Great Train Robbery
    b. Toll of the Sea
    c. The Al Jolson Story
    d. The Jazz Singer

62. Which item represents the type of motion picture film commonly used in single-concept loop cartridges?
    a. 8 mm
    b. 16 mm
    c. super 8 mm
    d. a and c

63. Which of these has proven especially beneficial in how-to-do it films?
    a. close-up photography
    b. micro-photography
    c. time lapse action
    d. color

64. A teacher must be knowledgable in several areas to effectively utilize audiovisual materials. Which item best represents an area in which teacher should have a basic understanding?
    a. Standardized tests
    b. I Q scores
    c. Learning theory
    d. Individual differences

65. Which item is not an example of good motion picture projection techniques?
    a. fading the volume when the film ends.
    b. gradually increasing the volume when the picture begins.
    c. darkening the room before starting the projector
    d. rewinding the film immediately after showing.

66. Which item represents the best utilization technique for still projected media?
    a. follow up activities
    b. a knowledge of composition
    c. skill in running audiovisual equipment
    d. flexible pacing

67. For a small child to correctly point out to his parents all the coffee tables in a furniture store, saying "Here's another coffee table dad," is an example of which type of learning according to Gagne
    a. signal learning
    b. concept learning
    c. rule learning
    d. problem solving

68. Which of these is used primarily to facilitate information storage?
    a. micro-film
    b. micro-projection
    c. film-strips
    d. 2 x 2 slides

69. Which slide size is sometimes referred to as a lantern slide?
    a. 35 mm
    b. 126
    c. 3 1/4 x 4
    d. 127

70. Material which reflects rather than allowing light to pass through it is called
    a. refraction material
    b. translucent material
    c. mirror image material
    d. opaque material

71. Which piece of equipment does not use film?
    a. carousel projector
    b. film-strip
    c. micro-projector
    d. micro fiche viewer

72. A major advantage of 2 x 2 slides is
    a. they are less expensive than filmstrips
    b. they have a smaller format than filmstrips
    c. the sequence of pictures can be more readily changed than filmstrips
    d. they are easier stored than filmstrips

73. Which of the following is not an appropriate use for filmstrips?
    a. to provide a basis for understanding symbols
    b. to help teach skills
    c. to show motion
    d. to focus group attention

74. Filmstrips which are accompanied by records are called
    a. slide-tapes
    b. visual recordings
    c. sound filmstrips
    d. viewgraphs

75. Slides which require specially designed glasses in order to view them are called
    a. bioptical slides
    b. stereo albums
    c. stereoviewers
    d. stereo slides

COMPETENCY IN INSTRUCTIONAL MEDIA 4001

FINAL EXAM

INSTRUCTIONS: Select the best response.

1. The text material for an overhead transparency master which will be used to make a transparency that will be mounted on a standard overhead projection mount should not exceed
   a. 10 x 10 inches
   b. 7 x 9½ inches
   c. 8½ x 11 inches
   d. 11 x 14 inches

2. Which process requires masters (or "originals") that contain a high carbon content?
   a. thermal
   b. Diazo
   c. dry photo-copy
   d. color-lift

3. Which of these usually will not reproduce on a thermal transparency?
   a. India Ink
   b. ball point pen
   c. soft lead pencil
   d. electrographic pencil

4. Which item represents an advantage of thermal transparencies?
   a. They can be produced from inks with a high carbon content
   b. multiple copies are easily produced
   c. masters can be made from colored pencils
   d. they look more professional than transparencies made by other methods

5. Which item represents a type of drawing material that is appropriate for producing handmade transparencies?
   a. grease pencils
   b. felt tip pens
   c. acetograph pens
   d. all of the above

6. Which of the following are criteria for selecting flat pictures for educational purposes?
   a. Clarity
   b. truthfulness
   c. suitability to the teaching concept
   d1 all of the above

7. Which of these is usually preferable when using flat pictures for instructional purposes?
   a. rapid inspection of many prints
   b. thoughtful study of a few prints
   c. they are equally sound practices
   d. neither is a sound practice

8. A suitable material for displaying photographic prints without damaging the print is
   a. straight pin
   b. thumb tacks
   c. glue
   d. an easel

9. Which of these materials is not used in dry mounting?
   a. rubber cement
   b. poster board
   c. dry-mount tissue
   d. butcher paper

10. Which material is used in dry mounting a flat picture?
   a. laminating film
   b. dry-mount tissue
   c. dry-mount
   d. contact paper

11. Which item is closest to the correct temperature setting of the heat press for laminating a visual when lamination is done in a dry maount press?
   a. 150 degrees
   b. 225 degrees
   c. 270 degrees
   d. 350 degrees

12. A type of graph that is useful for plotting trends is the
   a. bar graph
   b. line graph
   c. circle graph
   d. pie graph

13. Which of these represents a function of bulletin boards?
   a. they facilitate study of single copy materials
   b. they stimulate student interest
   c. they create an atmosphere conducive to learning
   d. all of the above

14. Captions used to draw the reader closer in order to present additional information is a characteristic of which of the following
   a. posters
   b. bulletin boards
   c. magnetic boards
   d. cling boards

15. Hook and loop boards are particularly advantageous for use with
    a. flannel cut-outs
    b. magnetic materials
    c. heavier objects
    d. none of these

16. Which item represents an advantage of clingboards
    a. inexpensive
    b. highly visual
    c. sequential development
    d. all of the above

17. A disadvantage of globe usage for instructional use is
    a. accuracy
    b. simplicity
    c. color
    d. bulkiness

18. What do we call three dimensional representations of real things which do not necessarily look like the object being represented?
    a. copies
    b. models
    c. mock-ups
    d. specimen

19. Which of the following items represent the most realistic instructional materials?
    a. globes
    b. dioramas
    c. models
    d. mock-ups

20. A major advantage of disc recordings as compared to audio-tape recordings is
    a. they are non-erasable
    b. they use capstan drive
    c. they are more easily operated
    d. they are commercially produced

21. Most broadcast educational television stations receive some programs from
    a. NBC
    b. FCC
    c. NET
    d. NRA

22. A device which allows visual images and accompanying audio to be recorded and played back at future times is the
    a. multiplexer
    b. video on camera
    c. synchronizer
    d. videotape recorder

23. Which item represents a function of the teacher who utilizes programmed instruction?
    a. motivation
    b. guidance
    c. coordination
    d. all of the above

24. The person generally credited with initiating the development of the "branching" approach to programming is
    a. Crowder
    b. Pressey
    c. Skinner
    d. Green

25. Which size of typewriter type is preferable for use in transparencies intended for general classroom use?
    a. pica
    b. elite
    c. primary (or primer)
    d. all sizes are equally acceptable

26. A translucent of transparent master is necessary for producing which type of transparency?
    a. Diazo
    b. Thermal
    c. Color-lift
    d. Dry photo copy

27. Transparencies produced by the dry photo copy method are developed by
    a. heat
    b. ammonia fumes
    c. photographic chemicals
    d. light

28. Many 3-M "Secretary" copiers have a color-coded dial for setting exposure . Which color setting is appropriate for producing thermal transparencies?
    a. red
    b. white
    c. green
    d. buff

29. Which of these practices can result in a savings in transparency film over a period of time?
    a. the use of test strips
    b. running the machine faster than usual
    c. running the machine more slowly than usual
    d. making duplicate transparencies for file

30. Which item represents an advantage of handmade transparencies?
    a. they can be produced quickly
    b. they are informal
    c. they are less likely to be ruined in storage
    d. multiple copies can be made quickly

31. Which item represents an advantage of the color-lift method of transparency production?
    a. color transparencies can be made from pictures in certain magazines.
    b. they do not require the use of transparent film
    c. they require little time to produce
    d. they have a professional appearance

32. Which of these is <u>not</u> a principle for the effective use of flat pictures
    a. use few rather may pictures
    b. integrate pictures with the lesson
    c. use color rather than black and white pictures
    d. use pictures for specific reasons

33. Which of these is most easliy available to classroom teachers?
    a. film strips
    b. mock-ups
    c. flat-pictures
    d. motion picture films

34. Which of these processes is the least messy?
    a. wet-mounting
    b. dry-mounting
    c. rubber cement mounting
    d. they are all messy--equally

35. Before laminating, flimsy materials should be
    a. soaked in hardening solution
    b. washed with vinegar
    c. dry-mounting
    d. sprinkled with talcum powder

36. Which item represents the correct temperature setting, in degrees F, for the dry-mounting process
    a. 250
    b. 270
    c. 225
    d. 265

37. Good instructional cartoons have three characteristics. Which item more nearly represents one of these characteristics?
    a. They must use highly abstract symbols
    b. The must be funny
    c. They must be appropriate for the experience level of the student
    d. They must be stirical in nature

38. Dramatic simplicity is a characteristic of which of the following?
    a. cling-boards
    b. chalkboards
    c. bulletin boards
    d. posters

39. Which of these is not characteristic of a good poster?
    a. simplicity
    b. attractiveness
    c. multi-purpose
    d. brief text

40. Which item represents an advantage of cling boards?
    a. content is easily manipulated
    b. student prefer three dimensional materials
    c. students enjoy making the instructional material
    d. a and b

41. The most important factor that enables students to distinguish features on globes is
    a. latitude lines
    b. lettering
    c. color
    d. embossed surfaces

42. Which item represents a type of audio material commonly used in conjunction with accompanying visual material?
    a. radio
    b. optical sound recordings
    c. disc recordings
    d. magnetic tape recordings

43. Which item represents a major advantage of audio-tape recordings as compared to disc recordings?
    a. they are more easily stored
    b. they are less expensive
    c. they are more available
    d. they are more easily produced by teachers

44. Most broadcast TV programs are transmitted over which frequency range?
    a. UHF
    b. AM-FM
    c. FCC
    d. VHF

45. A device which allows 2 x 2 inch slides, filmstrips, and motion picture film to be projected into a TV camera is a
    a. video tape recorder
    b. image orthocon viewer
    c. vidicon viewer
    d. multiplexer

46. Under FCC regulations, which size vidiotape must be used for television program broadcasting?
    a. one inch
    b. two inch
    c. one-half inch
    d. all of these

47. A major advantage of programmed instruction is that it can be used to
    a. teach foreigh languages
    b. disseminate information
    c. motivate students
    d. solve complex problems.

48. Branching programs usually utilize
    a. a constructed response
    b. a multiple choice response
    c. a true-false response
    d. a written response

49. "Multi-media" means
    a. use of more than one medium at a time
    b. being snappy and up-to-date in one's classroom presentations
    c. selection of media and design of instruction involves consideration of many possible media for the teaching job at hand
    d. a and c

50. With considerable justification, "Education" as a field of study and the methodology of teaching practice have both been criticized for lack of theoretical emphasis. Which of the following may help supply a needed theory base for instructional design and practice?
    a. communication theories
    b. systems and information theory
    c. learning theories
    d. all of the above

51. Verbal Association (Gagne, Type 4 learning) is, basically a particular form of what other type of learning?
    a. signal
    b. S-R
    c. chaining
    d. concept learning

52. When a child can correctly identify something he has never seen before, like a desk lamp, as being a member of a class of things (in a furniture store, "Gee dad, that's a desk lamp, isn't it), he is probably demonstrating
    a. how smart he is
    b. attainment of stimulus-response learning
    c. readiness to read
    d. attainment of concept learning

53. "Rule learning" according to Gagne, is a type of learning which
    a. is primarily restricted to the higher grades, where applications in civics and other classes may be made in which rules can be related to the personal lives of students
    b. occurs most frequently in the lower grades where much of the day's work in school is taken up in teaching rules for good and orderly behavior
    c. involves relationships between concepts, and are the same sort of things that are often expressed in the form of principles.
    d. is the highest form of learning

54. In this course, we have concluded with consideration of the problem of media selection and use from which of the following standpoints?
    a. that a teacher should find ways to use as much media as possible
    b. that media should be considered systematically in the institutional design process with an eye toward providing optimal in instruction, irrespective of amount of media use
    c. that the economics of education require that we use as little as possible of the expensive media
    d. that films and slides are wonderful

APPENDIX G

RECORDER VARIATION EFFECT

UPON COMPRESSION RATE[1]

Cassette Recorder	Dollar Value	Time at Normal Rate	Time at Compressed Rate	Compression Percent of Normal
Norelco Model 3310/94	69.95	4.83	3.43	71.01
Midland Model 12/110	39.95	4.81	3.41	70.89
General Electric ALC	29.95	4.91	3.48	70.87
Sound Design, 7619	34.87	4.83	3.43	71.01
Wollensak Model 860	69.95	4.91	3.48	70.87
Norelco 3302 A/94b	49.50	4.76	3.36	70.58
Copy-corder CC-103	499.95	4.73	3.38	71.45
Realistic SCT-3B	99.50	4.83	3.43	71.01
Ampex Model Micro-1	39.50	4.90	3.46	70.61
Mean		4.83	3.43	70.92

[1]Based upon a random representative 724 word sample from unit 12 of the Automated Media Program by W. R. Fulton, et. al.

APPENDIX H

MEAN DIFFERENCES IN TIME USED TO VIEW PROGRAMS

GROUPS I AND II (FORCED PACED)

GROUP III LESSON	MEAN TIME USED	RECORDING TIME	TIME OVERAGE	TOTAL TIME USED	TOTAL RECORDING TIME	OVERAGE CONVERSION
I	20.10	10.28	9.82			
II	23.73	11.92	11.81			
III	18.78	18.92	- .14			
IV	18.47	16.50	1.97			
V	10.15	7.35	2.80			
VI 1-1	15.57	11.33	4.24			
VI 1-2	15.47	14.70	.77			
VI 2-1	14.73	14.60	.13			
VI 2-2	13.84	11.07	2.77			
VII	16.57	13.83	2.74			
VIII	18.15	17.17	.98			
IX	14.68	12.37	2.31			
X	5.68	4.33	1.35			
XI	17.57	14.67	2.90			
XII	17.73	15.65	2.08			
XIII	11.47	9.20	2.27			
TOTALS				252.69 min.	203.89 min.	48 min. 48 sec.

MEAN DIFFERENCES IN TIME USED TO VIEW PROGRAMS

GROUPS III AND IV (SELF-PACED)

GROUP IV LESSON	MEAN TIME USED	RECORDING TIME	TIME OVERAGE	TOTAL TIME USED	TOTAL RECORDING TIME	OVERAGE CONVERSION
I	21.68	14.83	6.85			
II	31.10	26.83	4.27			
III	24.89	17.73	7.16			
IV	26.26	23.87	2.39			
V	14.10	10.40	3.70			
VI 1-1	17.94	15.00	2.94			
VI 1-2	23.57	21.08	2.49			
VI 2-1	20.63	20.98	-.35			
VI 2-2	22.21	16.10	6.11			
VII	20.94	19.83	1.11			
VIII	24.15	24.43	-.28			
IX	21.26	17.58	3.68			
X	7.21	6.18	1.03			
XI	22.68	21.08	1.60			
XII	22.63	22.37	.26			
XIII	14.36	13.18	1.18			
TOTALS				335.61 min.	291.47 min.	44 min. 08 sec.

APPENDIX I

OPINIONAIRE

This opinionaire is given to you so the instructor can have some feedback from the participants in this project. It is in two parts because there were two major groups involved. One group listened to tapes that were compressed in time and one group listened to tapes that were normal length.

DO NOT PUT YOUR NAME ON THE OPINIONAIRE AND ANSWER AS HONESTLY AS YOU CAN. Rate the statement by circling the number from 1 to 5, 1 being "disagree" and 5 being "agree" and 3 being "neutral".

CHECK THE PROGRAM IN WHICH YOU WERE INVOLVED.

_____a. Self-Paced, Normal Rate

_____b. Self-Paced, Compressed Rate

_____c. Forced-Paced, Normal Rate

_____d. Forced-Paced, Compressed Rate

IF YOU CHECKED b or d, TURN TO PAGE 3, IF NOT GO ON TO PAGE 2.

If you wish to make any comments about the competency program please use the reverse side of the opinionaire.

NORMAL RATE

1.	Wearing head sets was a drag.	1 2 3 4 5
2.	The lessons (each individual one) were to long.	1 2 3 4 5
3.	The lessons provided too much media information.	1 2 3 4 5
4.	I enjoyed listening to the tapes.	1 2 3 4 5
5.	I found it hard to discipline myself to listen attentively.	1 2 3 4 5
6.	Having the filmstrip on TV was better than having the filmstrip.	1 2 3 4 5
7.	The whole program was all too complicated for me to understand.	1 2 3 4 5
8.	I would rather have had a lecture hour by a live instructor	1 2 3 4 5
9.	I wasn't able to get a thing from the tapes.	1 2 3 4 5
10.	The text manual was essential for me and without it wouldn't have gotten a thing from the program.	1 2 3 4 5
11.	I would like to have more or my classes in this form.	1 2 3 4 5
12.	I would seek classes that have automated programs such as this.	1 2 3 4 5
13.	I liked the idea of sitting down, getting the information and clearing out.	1 2 3 4 5
14.	The audio portion was sufficient to get the desired information; the filmstrip on TV did not add anything.	1 2 3 4 5
15.	I would rather have organized group instruction rather than self-paced instruction.	1 2 3 4 5
16.	I heard that the other group was listening to compressed time tapes. I would have rather been in that group.	1 2 3 4 5
17.	I feel I know more about media machinery and media usuage than I did before I took the class.	1 2 3 4 5
18.	I believe this course will be valuable when I get to my first teaching position.	1 2 3 4 5

19. I feel confident now with media and its usuage. 1 2 3 4 5

20. I think it would have been more valuable if this course was a machinery laboratory only and leave out all the theory, 1 2 3 4 5

21. My overall evaluation of the course. (rate 1 to 5, bad to good.) 1 2 3 4 5

WRITE YOUR COMMENTS BELOW OR ON THE REVERSE.

COMPRESSED RATE

1.	I would like to see more modules in compressed rate audio-visual form.	1 2 3 4 5
2.	The lessons were hard to understand because they were too fast.	1 2 3 4 5
3.	If I had not had a manual I could not have passed the tests.	1 2 3 4 5
4.	The manual was essential to this program.	1 2 3 4 5
5.	I think I could have learned better if I had been in the normal rate group.	1 2 3 4 5
6.	I liked the compressed rate program, it was a challenge.	1 2 3 4 5
7.	The lessons were OK, but I could take it or leave it.	1 2 3 4 5
8.	I think compressed speech has great potential in education.	1 2 3 4 5
9.	I believe I could have listened to a faster rate after the first few lessons and would have done just as well.	1 2 3 4 5
10.	Frankly, the audio and visual portion was only an inconvenience, just give me a text book and leave me alone.	1 2 3 4 5
11.	The technology of the porgram (method of presentation) was OK once I understood how it worked.	1 2 3 4 5
12.	I had a lot more free time to study as a result of the compressed rate.	1 2 3 4 5
13.	I had a great deal of anxiety while listening to the compressed tapes.	1 2 3 4 5
14.	I feel the compressed rate demanded more of my attention and as a result I learned more.	1 2 3 4 5
15.	I like compressed speech tapes.	1 2 3 4 5
16.	It is essential for thorough learning to be able to replay the tapes more than one time.	1 2 3 4 5
17.	Knowing I could not hear the tapes but one time, I listened more attentively.	1 2 3 4 5

18. I think it would have been more valuable if this course was a machinery laboratory only and leave out all the theory. 1 2 3 4 5

19. It would have been more valuable to me if I had control over the rate of compression. 1 2 3 4 5

20. Compressed speech is OK but not for all kinds of subject matter. 1 2 3 4 5

21. I goofed off with the time I saved. 1 2 3 4 5

22. I feel confident now with media and its usage. 1 2 3 4 5

23. I heard that the other group was listening to normal rate tapes. I would have rather been in the other group. 1 2 3 4 5

24. My overall evaluation of the course. (rate 1 to 5, bad to good.) 1 2 3 4 5

WRITE YOUR COMMENTS BELOW OR ON THE REVERSE.

STUDENTS' COMMENTS

An opportunity was given to the participants in the study to write and present any comments they wanted to about the program. They were asked not to sign the comments but to be honest in their response. The following are the comments by groups:

Group I - Compressed rate-forced-paced

Group II - Normal Rate-forced-paced

Group III - Compressed rate-self-paced

Group IV - Normal rate-self-paced

GROUP I

"I was so busy trying to get the answers to the questions that I missed other parts of the film. I greatly enjoyed working the machines and that is really all I remember from this course. I only wished we had learned to operate more machines but touch and not TV. I feel doing something is more beneficial than reading or viewing a film about it."

"I did not learn how to operate the machines as I thought I would. I know very little more about the machines than I did before. I think for me, the class was a waste."

"I liked it being a blend of theory and mechanics as mechanics alone would have been dull. I enjoyed the challenge of compressed speech and wish it could be used in other fields."

"I would like to have learned how to operate more machines."

"If I had been in one of the self-paced groups I possibly would not have done everything I was supposed to. Compressed speech was OK after I got used to it. Normal probably would have been more boring."

"I think the course should entail more practical manipulation of AV equipment. I would like to have had the opportunity to run a movie projector. Otherwise the course was interesting and challenging."

GROUP II

"I enjoyed listening to tapes as compared to a lecturer. But, I feel I needed more time to observe the machines and gain practice in operating them."

"The tapes weren't too boring, however, I wish we could have actually worked with making transparencies, etc., and get down to working with the materials rather than 5 or 10 minutes a period."

"This experimentation of teaching a course is necessary, I am sure, but, why at the expense of the students' time--expecially the students in the block course which are very busy as it is. I believe that a lab situation is appropriate for this course with pass or fail grading system. The classroom learning of media should be a course offered electively."

"The class periods seemed to be cut short for the normal group and sometimes made us late for our 12:00 class. Also, I felt the class could have stressed the operation of the machinery for some reason I feel we needed it more than the background of media. It was an informative class."

"I enjoyed the course and I think more courses should be offered of this nature. The course allowed the student to be independently guided and yet follow a programmed outline".

GROUP III

"Was convenient if I had to miss or make up."

"I lost interest, couldn't ask questions. I like discussion. I took this particular class because I wanted a class under this instructor, was very disappointed. It could have been an interesting course. I picked up quite a lot of info I will use, of course. I could have learned as much with a text book and no class at all.

"It was hard to understand at first. I got used to it. I found myself waiting for answers to fill in the book and not comprehending the rest of the presentation. I also seldom looked at the TV, but kept my eyes on the workbook."

GROUP IV

"I feel that the course has a good purpose. But having the answers in the back of the book was the main thing I felt hurt the class. If a person missed an answer by listening, all one had to do was look it up in the book. Also when it was a pass or fail situation, that made one not want to put out as well as if one were competing for a grade."

"I think that the whole course was a waste of my time, I don't like having to spend my money so that this school can use me to run an experiment."

"I feel I gained a lot of valuable material."

"It would have helped if the lab instructor would not be in a bad mood so often. A smile helps get through another unit."

"Was a good course once I finally figured out what was going on."

"Review of the text at home following viewing the tapes was how I learned material."

"If class was to rely any more on the text than we did, then you need to obtain a second edition with the many errors corrected in order to use the self-test section, in particular, to the fullest."