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EFFECTS OF COMPRESSED SPEECH THEORY APPLIED TO

HEALTH OCCUPATIONS EDUCATION INSTRUCTION

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Abstract: The purpose of this study was to investigate (a) normal, (b) 40% compressed, and (c) 80% compressed speech presentations of conceptual data for the "Burns" chapter from the Multimedia Standard First Aid book. The material was presented to randomly assigned intact groups of health occupations education 9th, 10th, 11th, and 12th grade students from two country school systems in a southern state. There were overall differences among posttest scores attributed to presentation method adjusted, in an analysis of partial variance, for reading level and pretest score.

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Effects of Compressed Speech

    High school and college students enrolled in **health** occupations
programs are faced with increasing demands to learn more subject matter in
shorter amounts of time. One way to cope with this problem is to use more
efficient presentation and study techniques. Variable speed playback
recorders, as a means of presenting slowed or speeded recorded speech, have
been available as technical devices to educators and researchers.

    For decades it has been known that a person could think far more rapidly
than speak. Swanson (1984) revealed that the average person speaks at a rate
of approximately 150 words per minute (wPm) ; while the average listener can
listen at a rate of at least 450 **wpm.** He also reported that 54% **of** students
enrolled in elementary school, 67% of high school students, and 90% of college
students spend most of their instructional time in listening to teachers.

    Sullivan (1982) reported that speed listening has been employed with
different levels of students in a variety of learning modes such as
individualized and independent study, for different purposes such as reading
improvement and conceptual instruction. **No** studies were found using
compressed speech as an instructional methodology with primary focus on either
high school health occupations students or their curricula. However, a number
of investigators have studied increases in other areas. Myers (1978) utilized
varying rates of compressed speech with blind high school students and
concluded that the amount learned per unit of time was significantly improved
for those students listening to higher rates of compressed speech regardless
of their intelligence, grade, placement, or sex. She reported that blind
students reading braille normally cover only one-third of the material covered
by sighted peers in the same time frame. However, by listening to a normally
spoken recorded version, blind students increased their coverage to two-thirds

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of the material. Sullivan (1982) found the compressed speech technique resulted in reading comprehension and reading rate gains that were comparable to those made with the traditional visually paced group while studying adult university students. Reading disabled students, ages 9 and 10, also showed marked improvement under the compressed auditory condition; with performance identical to that of the normal group **(Marlowe, Egner, and Foreman,** 197'9) .

Research with compressed speech or speed listening for the past five years has suggested that the compressed auditory mode of learning may lead to greater opportunities to learn and to achieve academically for many HOE students, including those with reading or other learning problems. The primary purpose of this study was to examine relative performance of three intact groups of health occupations students at the high school level who were randomly assigned to (a) normal speech, (b) 40% compressed speech, and (c) 80% compressed speech treatments. Specific focus was on conceptual content of a chapter on **burns from the common textbook designated as background for the first-aid competitive event for health occupations students. The index of effectiveness of treatments on student achievement was labeled "posttest."** Covariates were levels of "reading" **(obtained from the California Achievement** Test [CAT] and "pretest" burn scores. Independent variables were labeled "rate" of speech compression, "school" of enrollment, '*grade" in school, "sex" and "race" of student. The hypothesis tested with the statistical model was. that there were no differences among **covariate** adjusted posttest means for the three different speech rates, based on **an** error mean squares corrected for systematic differences due to school conditioned by rate. Data also were collected for determining perceptual (affective) responses of subjects to treatment experiences and **will** be published at a later date because of space

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constraints.

Method

Subjects

Participants were students enrolled in health occupations programs of four schools in two school districts of a rural southeastern state. Participants from each school were selected because they had not completed the required first aid unit of instruction which included a section on burns. Administrative constraints mandated that the study be conducted with intact groups previously established in scheduling classes at the beginning of the academic year. There were 105 students in 9 classes (3 classes randomly assigned to each treatment rate). Not all rates were applied in each school. There were 33 students assigned to the normal speech group (125 to 150 wpm), 39 students to the 40% compressed group (175 to 210 wpm), and 33 students to the 80% compressed group (225 to 270 wpm). There were 19 male and 86 female, 44 black and 61 caucasian; 13 students were 9th, 39 were 10th, 33 were 11th, and 20 were 12th graders.

Materials

Textbooks. Multimedia Standard First Aid Student Workbook ([MNSFA], American National Red Cross, 1978) and Standard First Aid and Personal Safety (American National Red Cross, 1979) containing chapters entitled "Burns" were the textbooks providing conceptual content for constructing audio tapes at normal rate and at compressed speech rates of 40% and 80%.

Cassette tape player. The original tape, and all tapes played back during treatment, utilized a Bell and Howell (Model 3085) cassette tape player.

Speech compressor. The Varispeech II Audio Tape Compressor, produced and

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marketed by **Lexico** Corporation, **Waltham,** MA. , was used for 40% and 80% compressions of normal speech.

Instrument. The supplemented 31 item test of core questions from the MMSFA Workbook was the resource used, with permission, as pretest and posttest in the present study. The first item on the instrument *(not* one of the MMSFA items) tested suitability of each student for the study by validating that each had not previously completed a course in first aid. The 31 core questions (MMSFA items) followed. Ten additional items (demographics and student perceptual reactions) were added to the end for purposes of soliciting personal data and judgments believed *to* be relevant for interpretation of results. Three of the 10 added items did not appear in statistically models and are not considered in this report. "The content of . . . [MMSFA] is based on information provided by the Division of Medical Sciences, National Academy of Sciences, National Research Council. . ." (MMSFA, Acknowledgments, 1978). Validity and reliability results were not presented in MMSFA reports but were determined for the present sample and are reported below.

Six teachers rated the burn related conceptual content of the research instrument on each of four dimensions of content validity. The dimensions rated were (a) "The items represent the content," (b) "The items stress the most important areas in the content," (c) "The items are appropriate in format for the content," and (d) "The items proportionally sampled all major topics in the content." The rating scale ranged from 1 to 100 for each dimension.

Procedure

Calibration. An audio technician provided technical assistance for developing the compressed tapes. A professional drama and broadcasting personality read the script for taping at the normal rate to insure clarity,

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normal rate, and standard diction. One of the authors, after appropriate instruction, used the Varispeech II Audio Tape Compressor to compress the normal rate to 40% and 80% of the time required for normal delivery. The normal rate ranged between 125 and 150 words per minute for the 15 minute "normal" tape. With "40%" compression the delivery time was 9 minutes; with "80%," it was 3 minutes.

Treatment. Intact groups of subjects were randomly assigned to treatment rate: normal, 40% compression, and 80% compression. After randomized assignment of groups to treatment, the treatments were administered on a scheduled day within each school in classroom settings monitored by the authors and the respective classroom teachers. Validating demographic items" and the "retest" were given by the principal investigator two weeks prior to administering treatments.

A 5 minute orientation tape designed for practice in the conceptual area of "poisoning" was played immediately preceding each treatment. After the orientation session a practice examination similar to the burn test, but in the content area of posioning as presented on the orientation tape, was administered. The monitors explained that the treatment would be administered in the same manner. All questions were answered and the treatment was begun. The treatment tape was played, and "posttest" demographic, and perceptual responses were collected.

Beyond random assignment of group to treatment, there were no further direct controls. There were, however, statistical controls for sex, race, grade level, and school. Additional control of concomitant variation was effected through sequential analysis with reading level and pretest scores entered first into the statistical model. There wae no attempt to control for

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variations in hearing acuity among the subjects.

Statistical analyses. An interrater reliability coefficient was used *to* determine similarity in ratings profiles among six teacher reviewers **on** four dimensions for burn related items of the research instrument. An interitem consistency reliability coefficient for the 31 items composing the "posttest" also was computed for the 105 subjects.

The posttest model utilized principles of change data analysis presented in Cohen and Cohen (1983, pp. 414-423). **Covariates** in the posttest scores model were "reading" and "pretest." Demographics were "sex," "race," "grade," and "school." The manipulated variable was named "rate." "School" was nested within "rate." The final model used for analysis of **"posttest"** scores conforms to Cohen and Cohen's conceptualizations for "analysis of partial variance" with covariates entered in the first two positions, "rate" in **third position, and "school (rate)" in last** position. This **mode** 1 represented a second stage analysis after determining that the demographic variables "sex," and "race," and their interaction, as **well** as other two way interactions accounted for only chance **amounts** of variation in "posttest." "Grade" was deleted because of demonstrated statistical redundancy with the covariates.

Results

The Instrument

Reliability and validity. The interrater reliability computer for similarity among 6 teacher rating profiles on four dimensions of content validity was .52. An interitem consistency reliability (**Cronbach** Alpha) of .66 was computed for the 31 burn items administered to 105 subjects. Factor analysis was applied to the 31 **item** burn test producing a varimax-rotated,

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principal-factor solution for construct validity of five factors explaining
28.3% of observed variance in the 31 items. The analysis showed an overall
Kaiser measure of sampling adequacy equal to .50. Factors were named (a)
timeliness of treatment, (b) principles of treatment, (c) anatomy, (d) signs
and symptoms, and (e) types of burns. Sixteen items loaded above .40 on at
least *one* of the five factors, no item loaded *on* two or more factors. These
data indicate that **items** of the burn test **are** not very homogeneous, and that
variability is restricted in the right-wrong sense across all items. I terns
seem to be *too* simply stated with too few choices adequately to test
conceptual knowledge.

The Posttest Model

Analysis of partial variance (APV) was the method of choice for
accommodating multicollinearity (high intercorrelations among independent
variables in the model) due to unequal n in various cells of the posttest
model. Means for the treatment variable, compressed speech 'rate," are
reported in Table 1 as unadjusted and adjusted cell means. Significance tests
for adjusted means are also reported in Table 1. By Scheefe' tests, the
adjusted posttest mean for the normal speech group was significantly higher
than the adjusted means for both speech compression groups which do not differ
from each other. There were school differences, but these were confounded
with treatment rate.

School nested within rate produced significant simple school effects for
both compressed rates of speech. Within the normal group, adjusted posttest
means differed by at most 1.7 units; within the 40% group, the difference was
6.3 units; and within the 80% group, the difference was 8.6 units. The
complete APV model accounted for 1107 out of 1722 units (64.3%) of observed

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variability in posttest scores.

Table 1

<u>Analysis</u> of Bums Test Data

Mean Scores Broken Down **by** Independent Variable Values

Independent Variable and Values	n	Read Mean	Pretest Mean	Posttest Mean **Unadj**	Posttest Mean Adj
Rate of Speech					
Normal	33	9.56	27.58	32.52	33.44
40%	39	8.95	25.33	29.00	28.39
80%	33	8.23	26.39	18.24	27.70

Analysis of Variance of Posttest Scores

Score	df	Type I SS	F	P
Reading level (CAT)	1	642.08	98.23	0.00
Pretest score (burns)	1	117.99	18.05	0.00
Rate	2	**157.54**	12.05	0.00
School(Rate)	6	190.05	4.85	0.00

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Discussion

The Posttest Model

Observed differences between adjusted posttest scores for the three treatment rates suggest a clear superiority for normal speech over compressed rates. However, the highest scoring classes within the compressed rate groups School 1 (40%) and School 3 (80%)] have adjusted means that closely approximate overall mean performance for classes experiencing the normal rate. There aPPear to be unknown school specific influences that bear additional investigation. Potentially contributing variables uninvestigated in the present model were (a) hearing acuity, (b) listening skills, and (c) amount of practice with compressed speech.

Limitations

The limitations of the study were: (a) the intact group design externally imposed for school administrative reasons prohibited random assignment of subjects to groups, (b) routine administration of the CAT is only to 8th and 10th graders in the participating schools and reading levels of the students may have differentially changed, and (c) reliability and validity data for the burns instrument were not published by American Red Cross.

Conclusions and Recommendations

High school health occupations education students were able to learn new material from audio taped presentations. Present data indicate that compressed rates of 40% and 80% may be equal to the normal rate for presenting health occupations concepts to **some** high school students. Although Swanson (1984) reported the "average listener" can listen at **450 wpm,** some students in this study had difficulty with the maxima of 210 and 270 wpm. If audio taped

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presentations are utilized for instruction, it is recommended that teachers allow students the opportunity to develop listening skills at compressed rates. This may increase their acceptance of these faster rates and reduce the time involved in learning new information, especially in individualized Study .

   Drake (1984) recommended use of compressed audio tapes with individualized instruction but only after practice with compressed speech tapes. It appears that further study is needed with repeated practice of compressed audio tape presentations. **This** technology has the promise **of** being effective with less time invested in learning new information and is worthy of continued investigation.

   One concludes that further study of the potential of compressed speech in the area of health occupations education should continue. This method of instruction seems to be a natural technique for students with learning problems or for students **who** are involved in individualized study.

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