COMPREHENSION OF RATE - ALTERED DISCOURSE BY PRIMARY SCHOOL CHILDREN WITH IDENTIFIED AUDITORY OR VISUAL STRENGTHS

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This is to certify that the

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ABSTRACT

COMPREHENSION OF RATE-ALTERED DISCOURSE
BY PRIMARY SCHOOL CHILDREN WITH
IDENTIFIED AUDITORY OR VISUAL
STRENGTHS

By

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The major purpose of this study was to investigate the applicability of advantaged auditory instruction with learning disabled primary school children. Advantaged auditory instruction, in essence, implies that teaching to the learner's strengths and bypassing his deficits results in effective learning. The key notion underlying such a concept is that instruction be designed to capitalize upon individual strengths of learners. Deficits are not remediated directly.

To investigate this concept of advantaged auditory instruction, a sample of thirty learning disabled primary school children with reading problems were divided into two groups, auditory and visual, on the basis of identified communication channel strengths measured by the Illinois Test of Psycholinguistic Abilities. Each group listened to passages of connected discourse at an expanded, normal, and compressed rate of presentation. Each passage was

followed by an oral administration of a cloze technique comprehension measure. The cloze test had been modified by a standardized algorithmic procedure to provide subjects with two alternatives from which to choose in supplying deleted words. The hypothesis of major interest was that thosesubjects identified as auditory learners would be more able to comprehend rate-altered instruction than those identified as visual learners.

An Analysis of Covariance was used to control for initial differences in order to equate the groups formed through non-random assignment. Reading comprehension was used as the covariate. Academic grade level served as a blocking variable to increase precision. The design was two-way, fully crossed, with a single repeated measure. The two design variables, Type of Learner and Academic Grade Level, were analyzed with an Analysis of Covariance.

The repeated measure variable of Word Rate and the interaction of Type of Learner and Word Rate Measure were analyzed by an Analysis of Variance. All hypothesis testing was done at the .05 level of confidence set prior to the experiment according to traditional educational research conventions.

Findings

Four major hypotheses were tested in the investigation. None were rejected at the .05 level of confidence.

The obtained probability of the F-ratio for Type of Learner main effect and Academic Grade Level main effect was .08.

Conclusions

Based on the findings, since the null hypotheses could not be rejected, the alternative hypotheses could not be accepted.

Implications

While the findings of this investigation were not significant at the .05 level of confidence, the potential value of advantaged auditory instruction as an educational tool could not be summarily dismissed. Through retrospective analysis, two potential sources of investigator error were discussed. The discussion led to recommendations for further study as well as implications for the use of advantaged auditory instruction.

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To Shari and Amy

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CHAPTER I

STATEMENT OF THE PROBLEM

Need

The need for this investigation is developed under two general topics. These are: (1) The auditory channel of communication; and, (2) Advantaged instruction.

Auditory Communication

Americans live, today, in a verbal society. A large proportion of their communication time is spent in the reciprocal auditory-vocal interchange. To illustrate, it has been hypothesized that, "A person might write a book a year; read a book a month; and speak a book a week; but hears and listens a book a day."[1]

This phenomenon extends into the American schools and plays an important role in the delivery of instruction. Stanford Taylor, for example, reports that over 50 percent of a child's time in the elementary classroom is spent in the act of listening.[2] Further support for Taylor's contention comes from Lundsteen when she states that, "Listening

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[1]Sara W. Lundsteen, "Thinking Improvement Program," unpublished manuscript, 1966, p. 47.

[2]Stanford E. Taylor, Listening: What Research Says to the Teacher, National Education Association, 1973, p. 3.

accounts for over one-half the time in school activities. It is the most continuously needed Language Arts skill; and yet, traditionally, it has been the most neglected."[3]

In the primary and intermediate grades, according to Taylor, listening skills are more advanced than reading skills for children of average intelligence and scholastic ability. He feels that children in these grades prefer to listen rather than read, if offered a choice. Listening is a more common act, one that children have had many years of practice in performing.[4]

As children encounter reading problems, the reliance upon listening becomes even more marked. For example, Taylor concludes:

> In general, less competent students, those judged to be less intelligent and scholastically below average, show a marked preference for listening over reading in most learning situations and do retain more from listening. The slower student depends on the special attributes of listening for much of his understanding. In listening, he is assisted in interpreting content by the phrasing and expression of the speaker, while in reading he must construct his own linguistic units in order to realize meaning.[5]

Durrell adds further support by claiming, "In all primary grades, listening vocabulary is much superior to reading vocabulary. Listening is a broader channel for

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[3]Sara W. Lundsteen, op. cit., p. 47.

[4]Stanford E. Taylor, op. cit., p. 16.

[5]Ibid., p. 17.

acquiring information than is reading at this level, since reading skills are immature."[6]

Although the auditory channel of communication is heavily relied upon as the primary information receptor for many children, research and material development in the area lags far behind efforts in reading. Keller, for example, terms listening research, "embryonic" in comparison to research in reading and speaking.[7] Anderson, in calling for needed research in listening reports the following:

> Unfortunately, however, progress in the teaching of listening is hampered by the paucity of research in the field. In comparison with reading, virtually no research has been done in listening.[8]

He concludes:

> The more than 3,000 studies which have been made in the field of reading have given us considerable understanding of the physiology, psychology, and sociology of reading. We have no such body of knowledge about listening.[9]

Similarly, reading material development outdistances auditory material development. For example, a survey of 382 members of the Council for Exceptional Children's Division on Children with Learning Disabilities was recently

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[6]Donald D. Durrell, "Listening Comprehension versus Reading Comprehension," Journal of Reading 12, 6 (March, 1969): 457.

[7]Paul W. Keller, "Major Findings in Listening in the Past Ten Years," in Listening: Readings, ed: Sam Duker (New York: The Scarecrow Press, Inc., 1966), p. 145.

[8]Harold A. Anderson, "Needed Research in Listening," Elementary Education English Journal 34 (April, 1952): 216.

[9]Ibid., p. 223.

conducted to identify materials and techniques used with learning disabled children. By far the greatest number of identified materials and techniques were in the areas of "remedial reading" and "visual perception" (44 percent). Only 5 percent of the materials and techniques identified related to the auditory area and they were defined as "auditory perception" materials.[10] Although a proportion of those children identified as learning disabled suffer reading problems, it appears that few auditory materials are currently available for their instruction.

This lack of attention to auditory channel learning is apparent throughout much of the educational system and is not isolated within those materials employed with the learning disabled. For example, a report of the United States Department of Health, Education, and Welfare expresses this concern:

> Although educational studies have consistently demonstrated that the major percentage of children's class time and of adult communication is devoted to listening, proficiency in auditory communication skills has received only superficial and insufficient consideration. Lack of attention to children's listening competence is apparent both in the area of instruction and of research. Emphasis in elementary education has been directed to the development and perfection of those visual skills which facilitate learning; educators have been tireless in programming diagnostic, developmental, and remedial reading programs. Publishers have been unceasing in the production of

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[10]Corrine Kass and Rena Lewis, "Favorite Methods and Materials of the DCLD Membership," Division for Children with Learning Disabilities Newsletter III, 1 (Winter, 1973).

> illustrated books and visual aids. Auditory skills, meantime, have been neglected or taken for granted despite outstanding advances in audio educational equipment.[11]

To date, reading research and development efforts have far surpassed such efforts in listening. The need for systematic investigation into auditory channel instruction seems apparent.

Advantaged Instruction

There is a current emphasis upon individualizing instruction with optimum efficiency for educators at all levels. Individualizing instruction, for purposes of this study, is defined in terms of advantaged instruction. The Consortium on Auditory Learning defines advantaged instruction as:

> Instruction that focuses on those areas that are functioning at the highest levels and that takes advantage of the child's functioning ability to promote further learning; this approach bypasses those functioning aspects of the child that are low in an attempt to provide necessary information that can promote normal performance in his environment.[12]

Advantaged instruction, in essence, implies that teaching to the learner's strengths and bypassing his deficits results in effective learning. The key notion underlying such a concept is that instruction is designed to capitalize upon

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[11]U. S., Department of Health, Education, and Welfare, Experimental Listening Curriculum, Project No. 6-8477, 1969, p. 2.

[12]Glossary of Terms, The Consortium on Auditory Learning, unpublished manuscript, Michigan State University, 1974, p. 1.

individual strengths of learners. Deficits are not remediated directly. If, for example, a figure-ground problem were diagnosed in a child, an instructional program would be designed to bypass this problem rather than to remediate it. The child's strengths would be assessed and the instructional programming would be designed to match those strengths. Advantaged instruction is, then, matching the medium of instruction to learner strengths--not to remediating deficits.

The advantaged instruction concept has been operationalized, to some degree, at Oakland Community College, Bloomfield Hills, Michigan. Students are administered a battery of tests upon admission. Instructional formats are recommended matched to strengths identified in the testing. The administrators of the institution, Joseph E. Hill and Derek N. Nunney, further this notion of advantaged instruction by claiming: "An aim of the teacher is to diagnose the style of the student, determine his strengths, and begin to instruct him, utilizing media which will capitalize on his strengths. The task, then, is one of matching the cognitive style of the student to the style of the mode of presentation of information."[13]

One method of individualizing instruction in an advantaged manner may be the diagnosis of communication channel

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[13]Derek N. Nunney and Joseph E. Hill, Personalized Educational Programs, Oakland Community College Press, p. 1.

strengths prior to instructional programming. Scholars indicate that a segment of the general learning population experience difficulty when attempting to process information through the visual channel. For example, Wunderlich states, ". . .clinical data suggests that as many as 25% of children may be primary auditory learners."[14] Wepman takes this identification of auditory learners one further step by stating, "The need to individualize instruction, at least to the point of grouping visual learners and auditory learners separately at the onset of reading instruction, seems an obvious way to minimize the problem."[15]

Witkin, in discussing applications of listening research for educators, substantiates the grouping by strength idea by making this observation, "Because some children learn better auditorially than visually, auditory educational methods are assuming a larger role in the educational process."[16]

By diagnosing the generalized attribute of communication channel strength prior to instructional programming, more effective and efficient learning may result if, in fact, those attributes are matched with the instructional medium.

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[14]Ray C. Wunderlich, M.D., Kids, Brains, and Learning (St. Petersburg, Florida: Johnny Reads, Inc., 1970), p. 137.

[15]Joseph M. Wepman, "Auditory Discrimination, Speech, and Reading," Elementary School Journal 60 (1960): 332.

[16]Belle Ruth Witkin, "Auditory Perception--Implications for Language Development," in Listening: Readings, Volume 2, ed: Sam Duker (Metuchen, N.J.: The Scarecrow Press, Inc., 1971), p. 365.

Auditory instruction in the past suffered from a fixed rate of presentation set by the speaker and beyond the control of the listener. This is no longer the case. Rate-altered instruction, a relatively new technology, has the ability to change the rate of presentation with little effect upon vocal pitch and quality. When expanded (slowed) and matched with students needing more processing time (typing students, language students, retardates) they can be more effective than normal rates.[17] When compressed and matched with auditory learners, they may produce equivalent achievement in less time than normal rates. Thus, by providing input by way of an advantaged modality, the time saved could be used for additional instruction or remediating deficits.

This technology has advanced to the point where students will soon be able to manage word rates for themselves. The Cambridge Research and Development Group recently announced the granting of a patent for a Variable Speech Control. The mechanism will electronically speed up or slow down recorded speech without distortion. Manufacturers will be able to adapt the device to standard audio cassette recorders with estimated costs of less than $50 per unit.[18]

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[17]Emerson Foulke, "Exploiting the Opportunity to Read by Listening," Learning Through Listening, California State Department of Education, 1973, p. 22.

[18]Center for Rate Controlled Recordings Newsletter, Vol. 8, No. 2, February 15, 1974, p. 2.

A financially affordable innovation will be available for classroom use in the near future. If educators are to make profitable use of such available technologies, it seems important that those students most likely to benefit from such use be identified.

Mullaly, in 1972, called for such research. He indicated the need for studies that match the learning style strengths of children to rate-altered instruction.[19] That rate-altered instruction matched to learner strengths may provide effective and efficient learning will be investigated in this study.

Purpose

This research seeks to identify an advantaged instructional medium for use by learners who receive and process information primarily through the auditory channel. The fundamental question for this investigation might be framed as: "Will matching the medium of instruction to identified individual perceptual strengths result in more effective and efficient learning?"

Specifically, this research has a two-fold purpose. First, to identify those learners most able to benefit from auditory instruction through the administration of an

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[19]Lee J. Mullaly, Comprehension of a Narrative Passage by Primary School Children as a Function of Listening Rate and Reading Comprehension Level (Ph.D. dissertation, Michigan State University, 1972), p. 63.

existing standardized test (Illinois Test of Psycholinguistic Abilities).[20] And, secondly, to examine the effect of altering the rate of speech on comprehension as a function of the learners' perceptual strengths identified through the aforementioned testing procedure.

This study will attempt to investigate the notion that teaching to perceptual strengths--matching the medium of instruction to communication channel strengths--is an effective and efficient method of advantaged instruction.

Limitations of the Study

This study intends to investigate the comprehension of rate-altered instruction as a function of modality strength. Two limitations, however, must be stated. First, this investigation does not intend to train or remediate modality weaknesses. Rather than attempting to change learner characteristics, educators may do well to identify learner styles and match instructional media to those styles. Advantaged instruction based upon individual learner strengths may be more profitable than attempting to remediate deficits.

Consideration must be given to ethical questions regarding the remediation of learning styles. A cautionary

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[20]Samuel A. Kirk, James J. McCarthy, and Winifred D. Kird, Illinois Test of Psycholinguistic Abilities, Revised Edition (Urbana: University of Ill. Press, 1968).

note from Keogh illustrates the underlying philosophy of this thesis:

> On the basis of the evidence, it is not entirely clear whether permanent changes in functional styles can be achieved easily, if at all. That question awaits empirical test.
>
> A matter for consideration at another level is whether such changes should be attempted. There is little question that some modes of perceptual and cognitive organization are more compatible than others with the usual educational tasks; however, these same modes may be less adaptive for other areas of behavior or achievement. Value judgements as to relative importance of outcome behaviors affect questions of modification. The issue underlying modification of modes or styles may be essentially an ethical one. Modification may be inappropriate unless an individual child's functional style is so extreme as to be pathological or to preclude educational progress, since change toward a modal pattern may reduce or limit a number of aspects of individual differences of value. Traditionally, efforts at modification have been focused almost exclusively on bringing about changes in children. It seems reasonable to respond to differences in children's functional styles by modification or individualization of educational programs and goals. The ethical question is whether the child or the educational system will be the major focus of change.[21]

Second, this research is not an aptitude-treatment interaction investigation. While learning modality strengths will be identified and will provide the basis for discrete grouping, only one measure will be applied--an auditory measure. It is not the purpose of this study to demonstrate an interaction between separate auditory and visual treatments with auditory and visual learners. It is,

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[21]Barbara K. Keogh, "Perceptual and Cognitive Styles: Implications for Special Education," The First Review of Special Education (Philadelphia, Pennsylvania: Buttonwood Farms, Inc.), 1973, p. 98.

rather, to investigate the applicability of a particular instructional technique--rate-altered speech--with auditory learners. Visual learners, for purposes of this study, provide a control group.

The somewhat unique characteristics of the population under investigation here dictates to some degree these limitations. The sample will be taken from a population of children with learning problems; primarily, reading problems. These children, in effect, may be experiencing difficulty in visually processing symbolic information.

Because this population is composed of children with reading difficulties, auditory instruction may provide an alternative to conventional classroom methodologies. Auditory instruction may truly be of an advantaged nature in this situation. It will bypass those low functioning areas of the learners in question while providing instruction through a functional channel.

Definitions of Key Terms

Definitions of terms used in this study are provided in this section. Terms defined are not arranged alphabetically; rather, they are ordered in groups bearing some degree of relationship.

1. Hearing: The process by which speech sounds in the form of sound waves are received and modified by the ear.[22]

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[22]Stanford E. Taylor, Listening: What Research Says to the Teacher, National Education Association, 1973, p. 6.

2. Listening: The process of becoming aware of sound sequences. In listening to speech, the person first identifies the component sounds and then recognizes sound sequences as known words through the avenues of auditory analysis, mental reorganization, and/or association of meaning.[23]

3. Auding: The process by which the continuous flow of words is translated into meaning. Auding involves one or more avenues of thought--indexing, making comparisons, noting sequence, forming sensory impressions, and appreciating.[24]

4. Compressed Speech: Speech that has been accelerated by electro-mechanical processes through the use of the Varispeech I for the purposes of this study. The speed of the narrative passage is reproduced in less time than that of the original recording, materially eliminating distortions in vocal pitch and quality as may be common with accelerated or rapid speech.

5. Expanded Speech: Speech that is slowed or reduced in rate from the original recording through a similar process described in (4) above.

6. Modified Cloze Technique: This is a test of comprehension that samples from the domain of the information

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[23] Ibid., p. 6.

[24] Ibid., p. 6.

presented. After a listening passage is presented to the subject, it is presented again with every 5th word deleted. Two options are given the subject to replace the deleted word. The subject chooses a replacement from the options.

7. Auditory Learner: A child whose preference for or measured strengths would indicate a facility for learning through the auditory modality.[25]

8. Visual Learner: A child whose preference for or measured strengths would indicate a facility for learning through the visual modality.[26]

9. Varispeech I: Used in the study, it is an electronic compressor/expander developed by Professor Francis Lee, an electrical engineering faculty member of M.I.T., and manufactured by Lexicon, Inc. This rate changer includes a cassette transport on which the signal to be altered is reproduced, and a small, special-purpose computer which obtains from the input signal the samples that are reproduced consecutively in the altered output.[27]

10. Specific Learning Disability: Children with special (specific) learning disabilities exhibit a disorder in one or more of the basic psychological processes involved

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[25]Glossary of Terms, The Consortion on Auditory Learning, Unpublished manuscript, Michigan State University, 1974, p. 1.

[26]Ibid., p. 6.

[27]Emerson Foulke, ed., Center for Rate-Controlled Recordings Newsletter, Vol. 7, No. 5, May 15, 1973.

in understanding or in using spoken or written language. These may be manifested in disorders of listening, thinking, talking, reading, writing, spelling, or arithmetic. They include conditions which have been referred to as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia, developmental aphasia, etc. They do not include learning problems which are due primarily to visual, hearing, or motor handicaps, to mental retardation, emotional disturbance, or to environmental disadvantage.[28]

Theory and Rationale

The primary purpose of this study is to examine the effects upon learning of matching the medium of instruction to identified communication channel strengths. This research is conceptually grounded in what Salomon terms, a "Preferential Model" of instruction. Salomon emphasizes the potential of capitalizing upon generalized learner aptitudes in educational programming.

> To be able to capitalize on and make use of an existing aptitude it needs to be general enough so that the learner can use it in processing the new information. If it is not general verbal or visual ability, but more task specific, there is little you can capitalize on. Rather, a more stable attribute,

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[28] U. S. Congress, Subcommittee on Education of the Committee on Labor and Public Welfare, "Notes and Working Papers. . .," Education of Handicapped Children (Washington, D. C.: U. S. Government Printing Office, May, 1968), p. 14.

perhaps even a "style" may appear to be more helpful in the present case.[29]

Underlying this theoretical model are such assumptions as:

1. Children bring unique sets of inter- and intra-individual learning abilities to an instructional experience.

2. These abilities may be assessed and measured, at least in a gross, generalized manner.

3. Various instructional media and formats demand different learning abilities for successful interaction.

4. When learning abilities are matched to the medium of instruction, more effective results are produced.

It is important, however, to experimentally investigate the underlying constructs of such a preferential model prior to its use in the classroom.

General research questions such as the following should be answered. First, will matching the medium of instruction to individual learner's strengths result in more effective and efficient instruction? More specifically, will students identified as auditory learners be better able to comprehend compressed speech than those identified as visual learners? Also, will different types of learners (auditory or visual) differ in their abilities to comprehend expanded speech?

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[29]G. Salomon, "Heuristics for the Generation of Aptitude-Treatment-Interaction Hypotheses," Paper from the Hebrew University of Jerusalem, Israel, 1971, pp. 12-13.

Secondly, are children in higher academic grades more able to use rate-altered instruction than those in the lower grades? And finally, can the ITPA (Illinois Test of Psycholinguistic Abilities) successfully identify those students most able to benefit from a particular instructional technique?

Hypotheses

Based upon the purposes of this study and framed within a preferential model of advantaged instruction, the following hypotheses have been drawn. In each case, the ability of "learning disabled" primary school students to learn from rate-altered instruction will be tested with a modified cloze technique.

1. The Auditory learners' mean score will exceed the Visual learners' score.
2. The Third grade level mean scores will exceed Second grade level mean scores, which will in turn exceed First grade level mean scores.
3. The Expanded rate mean score will exceed the Normal rate mean score, which in turn will exceed the Compressed rate mean score.
4. There will no learner by rate interaction.

Overview of Thesis

The remainder of the thesis is organized in the traditional manner. In Chapter II, the pertinent literature is reviewed under five major categories. In Chapter III, the design of the study is presented, including a description

of the sample; the measures developed and employed; the design matrix; the testable hypotheses; and the analysis techniques. The results of the study are presented in Chapter IV. A summary, discussion, and implications for future research are presented in Chapter V.

CHAPTER II

REVIEW OF RELATED LITERATURE

The literature review is organized under five major headings. These are: (1) The relationship between listening and reading skills in the primary grades; (2) Listening comprehension measures; (3) Individual differences; (4) Rate-altered instruction; and (5) The Illinois Test of Psycholinguistic Abilities.

Listening and Reading Skills

Auditory reception is viewed as a three-stage hierarchy by Taylor.[1] These stages are ordered from the gross act of hearing a sound to the finer acts of discrimination and attaching meaning. The first stage in the sequence is termed hearing; the gross act of receiving speech sounds. The second stage is listening; the recognition of sound sequences as words. In the final stage, auding, the flow of recognized words is translated into meaning.

A gross visual analogy to the auditory reception stages of hearing, listening, and auding might be looking, seeing, and reading.

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[1]Stanford E. Taylor, Listening: What Research Says to the Teacher, National Education Association, 1973, p. 6.

The stages in the hierarchy and the factors which act upon the auditory reception process appear in Figure 2.1 on the following page.

Development of Listening and Reading Skills

Consideration of auditory strengths is a central focus of this research. Large amounts of classroom time are spent in the act of listening; especially in the elementary schools. Many scholars have examined the comparative development of reading and listening skills by children in these grades.

Durrell, for example, developed comparable, standardized measures of listening and reading comprehension for grades one to eight. These language comprehension tests were equated to provide raw score comparisons between listening and reading. They were standardized on populations of three to four thousand children at each grade level. One index of the listening-reading relationship used by Durrell was that of listening grade equivalents. These grade equivalents are presented in Table 2.1.[2]

From the data in Table 2.1, it can be seen that listening comprehension raw scores exceed reading scores until grade eight where they are equal. Furthermore, the last

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[2]Donald D. Durrell, "Listening Comprehension versus Reading Comprehension," Journal of Reading 12, 6 (March, 1969): 458.

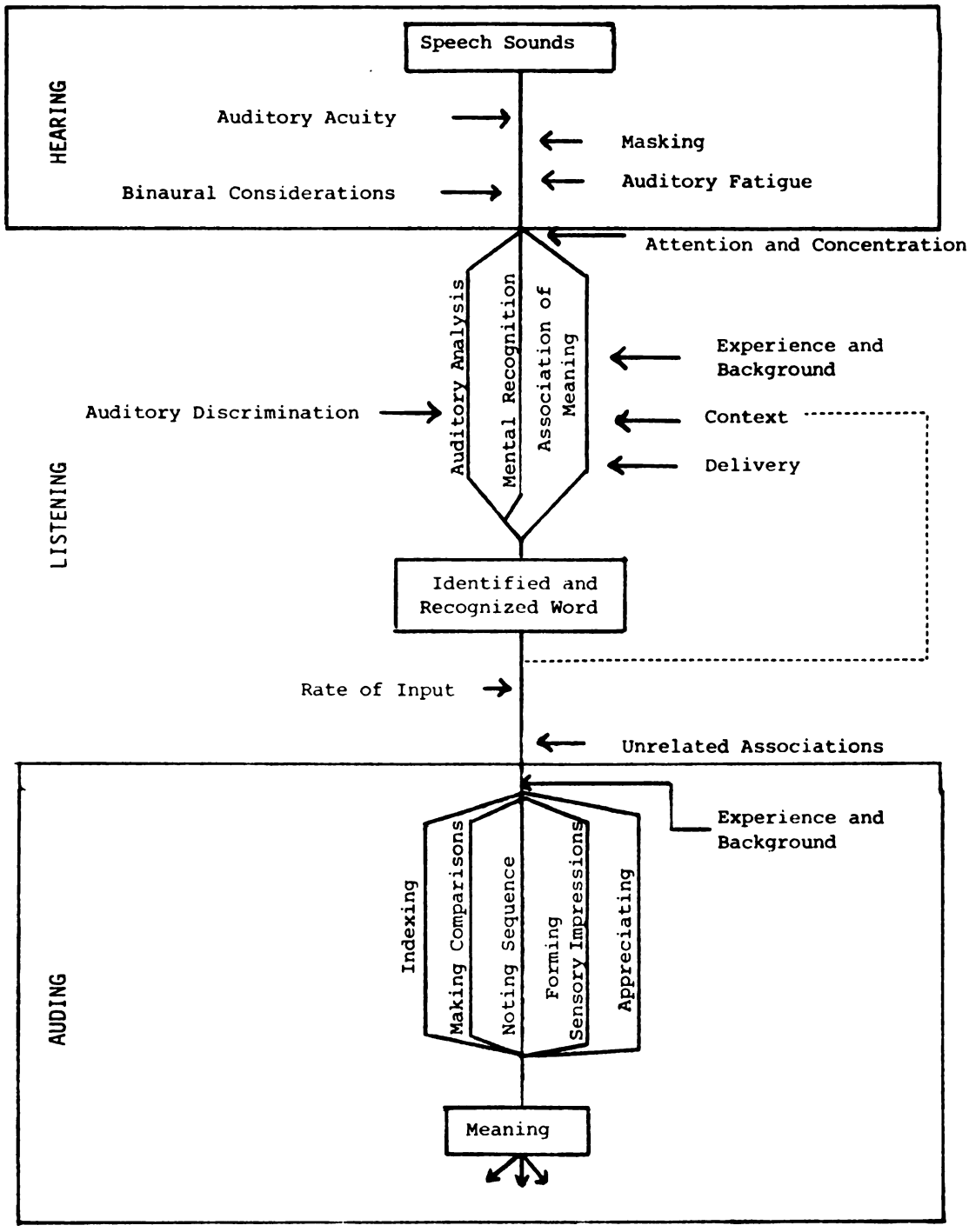

Figure 2.1.--The Process of Auditory Reception.[3]

[3]Ibid., p. 5.

TABLE 2.1.--Listening Equivalents to Reading Grade Versus Reading Grade (Vocabulary).

	Listening		Reading		Listening above Reading (yrs-mo)
	Score	Equivalent to Reading Grade	Score	Grade	
Primary Forms					
Grade 1	75	3.1	37	1.5	1.6
Grade 2	82	3.6	58	2.5	1.1
Intermediate Forms					
Grade 3	46	4.6	35	3.5	1.1
Grade 4	54	5.4	45	4.5	.9
Grade 5	61	6.2	55	5.5	.7
Grade 6	69	7.1	64	6.5	.6
Advanced Forms:					
Grade 7	130	7.9	122	7.5	.4
Grade 8	137	8.5	137	8.5	.0

column of the table indicates the grade equivalent superiority of listening comprehension for grades one through seven. This normative data may be used to assess the level of reading a child could understand if the information were presented orally.

Studies in the vocabulary development of children reveal similar findings. Armstrong conducted a study of aural and visual vocabulary development for two hundred children in grades one through eight. His findings are summarized in Table 2.2.[4] The data from Armstrong's study

[4]Hubert Coslet Armstrong, "The Relationship of the Auditory and Visual Vocabularies of Children" (Ph.D. dissertation, Stanford University, 1953), p. 107.

TABLE 2.2.--Aural and Visual Vocabulary Development for Children in Grades One through Eight.

Age	Mean Number of Words Visually Known	Mean Number of Words Auditorially Known (Includes Number in Column 2)
6-6	848	3,048
7-6	1,184	3,476
8-6	1,900	4,240
9-6	4,040	5,120
10-6	6,040	6,600
11-6	6,080	6,640
12-6	7,240	7,480

illustrates the apparent strength of the auditory vocabulary for children in the primary and elementary grades.

Taylor compared listening and reading skills of children in terms of word recognition rate. This efficiency measure indicates the relative advantage of listening in the early grades in terms of recognition time.[5] Not until grade six do children recognize words visually as quickly as those presented auditorially. Furthermore, reading rate does not approach listening rate until grades five or six. It appears that listening is a more efficient channel of instruction in the early grades. If an adequate level of comprehension can be maintained at accelerated listening rates, the auditory

[5]Standord E. Taylor, op. cit., p. 16.

TABLE 2.3.--Listening and Reading Word Recognition Rates.

	Grade Level													Very Efficient
	1	2	3	4	5	6	7	8	9	10	11	12	Col.	
Average Recognition Time per Word (in seconds) LISTENING	← .33 sec. → Based on average adult speaking rate--175-185 w.p.m.													
READING	.75	.52	.43	.38	.35	.32	.30	.29	.28	.26	.25	.24	.22	.12
Average Rate (in words per minute) LISTENING	← 175 - 185 →													
READING	80	115	138	158	173	185	195	204	214	224	237	250	280	500

channel becomes even more efficient in terms of learning per unit of time.

Many scholars have indicated the relative superiority of the auditory channel in the early grades. Reading skills, at this age, are not yet developed to the same extent as listening skills. This comparative advantage tends to be maintained for those children with reading problems at the primary level and extends until adulthood. For example, Emslie and others presented eight stories to 132 elementary students during four sittings. One story was read aloud to the pupils and one was read silently at each of the sittings. Poor readers did better in listening than in reading.[6]

Similarly, Friedman reported that elementary children had better comprehension of material presented orally than of material they read. Slow readers showed the greatest difference in favor of oral presentation.[7]

Fenwick suggested that many slow-learners, while possessing marked reading retardation when measured by standardized test scores, had developed compensatory

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[6]Elizabeth A. Emslie, Margaret E. Kelleher, and Judy D. Leonard, "A Comparison of Achievement in Silent Reading and Listening in Grade four," in Listening Bibliography, Second Edition, ed: Sam Duker (Metuchen, N.J.: The Scarecrow Press, Inc., 1968).

[7]Robert M. Friedman, "A Comparative Study of the Retention Level of Verbal Material Presented Visually and Orally: Fifth Grade Pupils," in Listening Bibliography, Second Edition, ed: Sam Duker (Metuchen, N.J.: The Scarecrow Press, Inc., 1968).

abilities in aural-oral skills which enabled them to function on a cognitive level substantially higher than that normally indicated by scores from either achievement test batteries or individual measures of intelligence. He explains, ". . . the true learning capacity of the student might be more nearly realized in terms of those situations depending primarily on instructional strategies involving the aural approach."[8]

Further research relating listening and reading skills for individuals with reading deficits is reported by Sticht:

> . . . many men who read poorly preferred to learn by listening rather than by reading. This suggests that the provision of listening materials in addition to reading materials in training programs and on the job might motivate learning where it otherwise would not even be attempted.[9]

The listening literature indicates the feasibility of using auditory instruction on many levels. Certainly, it has application in the primary grades. As children leave school they will listen much more than they will read. It seems important that auditory instruction be emphasized in the classroom, especially for those children with reading problems. If a child with an intact auditory channel

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[8]James J. Fenwick, "Slow-Learners and Listening," Listening: Readings, Volume 2, ed. Sam Ducker (Metuchen, N. J.: The Scarecrow Press, Inc., 1971), p. 104.

[9]Thomas G. Sticht, "Learning by Listening," Paper presented for C.O.B.R.E. Research Workshop on Language Comprehension and The Acquisition of Knowledge, Rougemont, North Carolina, March, 1971, p. 23.

is experiencing difficulty in reading, then a viable alternative may be aural instruction.

Listening Comprehension Measures

There is little doubt that reading and listening are related language skills. Durrell, for example, terms beginning reading as, ". . . essentially a task of searching for speech patterns in print: letters and letter clusters are related to speech sounds; printed words and sentences are translated into speech."[10]

Many scholars have investigated this relationship. Duker, for example, reviews twenty-three such studies reporting coefficients of correlation between listening and reading. These ranged from .45 to .70, with a mean of .59, indicating a strong positive relationship between the two skills.[11] Much of this research, however, used available standardized listening comprehension measures which have met with recent criticism.

Devine, for example, reports:

> Investigators regularly note that both kinds of behavior are related in that (a) both are concerned with the intake half of the communications process, (b) each seems to be a complex of related skills components, (c) the same higher mental processes seem to underlie both, (d) high correlations exist between test scores in reading and listening, and (e) the teaching of one seems to affect the other.

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[10] Donald Durrell, op. cit., p. 455.

[11] Sam Duker, Listening: Readings, Volume 2 (Metuchen, N. J.: The Scarecrow Press, Inc., 1971), p. 69.

He questions some of the underlying assumptions resulting from past research, however:

> The second basic assumption about reading and listining to be reexamined in the light of recent research is that listening and reading test scores correlate highly.
>
> . . . recent studies have raised serious questions about the listening tests used to establish correlations. Anderson and Baldauf analyzed the Sequential Tests of Listening Comprehension Test (Form 4), and concluded that heavy loadings in verbal comprehension suggested that achievement on the test may be a matter of verbal comprehension and not listening as a distinct ability. Kelly studied both the STEP Listening Comprehension Test and the Brown-Carlsen Listening Comprehension Test, and concluded that the construct validity of each was questionable because neither test correlated significantly higher with the other than with reading and intelligence tests. It may be that much of the existing statistical evidence commonly accepted in studies of the reading-listening relationship is invalid.[12]

A third published standardized listening comprehension test, the Orr-Graham, was reviewed in The Seventh Mental Measurements Yearbook.

> Those who believe that the teaching of all the communication skills is a primary function of the schools may be heartened by the appearance of a new listening test. They will, of course, view with dismay the fact that more than 40 years after Paul Rankin's pioneering inquiry into the state of listening there are only three published standardized tests of listening. They will, moreover, despair over the realization that none of the lonely company of listening tests comes anywhere near the level of sophistication that has been attained in the measurement of other skills.
>
> The Orr-Graham Listening Test does not, unfortunately, provide an alternative to the Sequential Tests of

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[12]Thomas G. Devine, "Reading and Listening: New Research Findings," Listening Readings, Volume 2 (Metuchen, N. J.: The Scarecrow Press, Inc., 1971), pp. 82, 84.

> Educational Progress: Listening or the Brown-Carlsen Listening Comprehension Test for its focus is much too narrow.[13]

The review is concluded with the statement, "The education profession is still without a first-rate instrument for the measurement of listening skill."[14]

Existing standardized instruments for measuring listening comprehension provide limited alternatives as research tools. The result, then, has been for researchers to develop their own measures. One such development technique is the cloze procedure.[15,16]

Carrol defines this form of comprehension as, ". . . the ability to supply missing elements in messages."[17]

> The procedure involves taking a passage of text and deleting words in it by some rule, e.g., every 5th word, every other noun, or every other "function" word. A subject is then presented with the passage and asked to guess the missing words. Usually the passage is presented in written form, in which case the missing words are indicated by blanks of a standard size, but techniques are also available for presenting the passage in auditory form.

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[13]Oscar K. Buros, ed., The Seventh Mental Measurements Yearbook, Volume II (Highland Park, New Jersey: Gryphon Press, 1972), p. 636.

[14]Ibid., p. 639.

[15]Milton Dickens and Frederick Williams, "An Experimental Application of 'cloze' Procedures and Attitude Measures to Listening Comprehension," Speech Monographs, June, 1964, 31: 103-108.

[16]Ronald D. Carver, "On The Relationship Between Understanding and Information Stored During the Reading and Auding of Prose Materials," Unpublished manuscript, 1971.

[17]John Carrol, ed., Language Comprehension and the Acquisition of Knowledge (Washington: V. H. Winton: distributed by the Halsted Press Division of Wiley, New York, 1972), p. 18.

> . . . The procedure has gained considerable acceptance as a measure of the individual's degree of comprehension of a given text.

Suggested by Foulke for use in testing comprehension of auditory materials, the cloze technique bypasses some of the problems usually inherent in other researcher-developed testing instruments.[18] David Orr describes:

> Most typically, the multiple-choice listening analog to the standard reading comprehension test is the thing that gets used to determine comprehension. There are several particular problems with this approach. In the first place, it's very difficult to produce a research instrument which is a psychometrically adequate test.
>
> . . . There is also a problem which can be called the "domain" problem. Ideally, the test ought to be an unbiased and representative sample from the domain of material which was presented to the listener for comprehension.
>
> . . . A third point with respect to multiple-choice tests has to do with prior knowledge. Questions which the individual can answer on the basis of knowledge that he got elsewhere than listening to the passage are irrelevant with respect to measuring comprehension, at least of that particular presentation.[19]

The cloze technique, however, is not without its problems, too. In factor-analyzing the ability to comprehend time-compressed speech, Carver and others concluded, "The cloze test used as a measure of comprehension includes a large component of variance unrelated to comprehension

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[18]From a taped presentation by Emerson Foulke at Michigan State University, November 14, 1973.

[19]David B. Orr, "The Measurement of Listening Comprehension," Proceedings of the Second Louisville Conference on Rate and/or Frequency-Controlled Speech (Louisville, Kentucky, 1969), p. 220.

and quite specific to the cloze technique itself."[20] Carver does report, however, "The normal cloze variable loaded highest on the Cloze factor (1.10), yet it also loaded substantially on the Comprehension factor (.42). This latter result lends support for the definition of Factor I as a Comprehension factor."[21] He further states, "The cloze task is a recall task which is probably quite appropriate for studying the memorization of prose material."[22]

The standard cloze technique requires subjects to supply deleted words from a prose passage previously presented in its entirety as a stimulus. This task has been found to be inappropriate for use in the primary grades. Deutsch and others consider the standard cloze procedures too difficult for adequate listening comprehension measurement with young children.[23]

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[20]Ronald P. Carver, Raymond L. Johnson, and Herbert L. Friedman, "Factor Analysis of the Ability to Comprehend Time-Compressed Speech," Journal of Reading Behavior, 4, 1 (Winter, 1971-72): 10.

[21]Ibid., p. 47.

[22]Ronald P. Carver, op. cit., p. 10.

[23]Martin Deutsch, Alma Maliver, Bert Brown, and Estelle Cherry. Communication of Information in the Elementary School Classroom, Cooperative Research Project No. 908 (New York Medical College: Institute for Developmental Studies, 1964), p. 82.

A modified cloze technique termed, "Reading-Input," has been developed to replace standard cloze procedures.[24] Reading-Input may be considered a second generation cloze technique, retaining the advantages of a standard cloze, but having two distinct benefits beyond it.

First, Reading-Input measures differ from traditional cloze measures in that options are given subjects to choose from in replacing the deleted word. For example, if the fifth word of a passage were deleted and the subject were asked to supply that missing word, a Reading-Input measure would give the subject two or more alternatives to choose from in replacing the deleted word. Traditional cloze measures do not allow the selection from alternatives. This greatly reduces the difficulty of the task, making it more appropriate for younger children.

Secondly, Reading-Input measures have a further advantage in that a standardized algorithmic procedure is used to construct the measures. In this manner, experimenter bias can be eliminated in both the construction of the materials and the scoring of the results.

Carver points out that the Reading-Input technique bears resemblance to the standard cloze in both format and use.

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[24]Ronald P. Carver, "Revised Procedures for Developing Reading-Input Materials and Reading-Storage Tests" (Washington, D.C.: American Institutes for Research, October 12, 1973).

> First of all, reading-input may be used to assess the readability or difficulty of materials as Taylor originally used the cloze technique. Reading-input may also be used to facilitate the amount learned from prose materials in a manner similar to the way that cloze has been employed. A third possible use of reading-input would be to facilitate improvement in reading skill in a manner similar to the way that cloze has been employed. Fourth, the reading-input technique could also be used to assess the degree to which an original prose passage had been understood or comprehended, as the cloze technique has been used.[25]

Reading-input measures of listening comprehension appear to offer a viable alternative to the three published listening tests available. (STEP, Brown-Carlsen, and Orr-Graham). Additionally, the standardized reading and listening comprehension tests developed by Durrell are available with only single sentence comprehension measures at the primary level. Furthermore, the reading-input technique seems to offer advantages to researchers developing their own measures, especially at the primary level.

Individual Differences

Providing for individual differences in learning situations has received much attention in educational literature. While most educators would agree that accommodations should be made for aptitudes of learners entering instructional systems little, seemingly, is evidenced in

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[25] Ibid., pp. 10-11.

the nation's classrooms. James Beaird expresses it this way:

> It is true that we have spent, as educators, a great deal of time and effort talking about provisions for individual differences in our instructional programs. Unfortunately, woefully little active adaptation to individual differences has been made in instructional programs. This is especially true in the development of instructional media.[26]

Beaird continues by indicating profitable emphases for instructional technologists:

> The most fruitful approach and the one that Cronbach (1967)[28] terms the most "psychologically interesting" approach is that of modifying the instructional setting such that it is adaptive to salient and meaningful psychological differences in individuals. While the latter course is not an easy one to negotiate, increased attention to such alternatives by instructional technologists can significantly contribute to successful adaptations to individuality.[27]

Concerns of educators might be viewed, then, as involving the matching of media, materials, and methodologies to the relevant characteristics that individual learners bring with them to the classroom. As Cronbach states,

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[26]James H. Beaird, "Learner Variables and the Instructional Technologist," The Contribution of Behavioral Science to Instructional Technology, Oregon: Teaching Research, A Division of the Oregon State System of Higher Education, III-3.

[27]Ibid., III-4.

[28]U.S., Department of Health, Education, and Welfare, Lee J. Cronbach and Richard E. Snow, Final Report: Individual Differences as a Function of Instructional Variables, Contract No. 4-6-061269-1217, p. 175.

"The demand is that educators invent new programs to open opportunity to persons who would not succeed in attaining traditional goals in traditional ways."[29]

The development of new technology should greatly extend the range of methodologies for teachers to deal with learner variations. Hopefully, these innovations will be designed to teach to perceptual strengths of students. The process of remediation is of questionable value. As Beaird reports:

> The underlying assumption to remediation, of course, is that once the student has eliminated his deficiencies he may rejoin the rest of the group ready to try again. Logically it can be expected that remediation will lead to improvement in many important aspects. All too often, the group, continuing at its pace, has tended to move even farther ahead of the remedial student; thus placing his future success in a tenable position.[30]

Keogh cites the importance of individual variations in cognitive style by stating:

> It is presumed that cognitive styles interact with instructional strategies to facilitate or impede learning. Inclusion of cognitive style as a significant variable in planning of curricula and instructional programs may maximize learning efficiency. Despite special education emphasis on individualization of program, application of the construct of cognitive style to exceptional children has been limited. The area of study seems promising, especially when applied to children with educational problems.[31]

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[29] Ibid., p. 175.

[30] James H. Beaird, op. cit., III-14.

[31] Barbara K. Keogh, op. cit., p. 84.

There should be payoff for children if their perceptual strengths are matched to the instructional program. Sabatino and Streissguth divided a sample of children with learning disabilities into two groups--one with auditory perceptual strengths, the other with visual perceptual strengths. An experimental Word Form Configuration Training Program (all visually oriented) significantly modified visual perceptual behavior in the experimental groups of visual children, but not the audile children. They concluded that teaching to perceptual strengths, rather than concentrating on remediating weaknesses appears to be a more effective strategy.[32]

Some researchers have investigated the efficacy of choice and preference in educational programming rather than a measured assessment of learner aptitude.[33] Sticht, however, found that preference for one mode of instruction over another (listening over reading) did not predict success in that channel.[34] Although student involvement in the

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[32]David A. Sabatino and W. O. Streissguth, "Word Form Configuration Training of Visual Perceptual Strengths with Learning Disabled Children," Journal of Learning Disabilities, 5, 7 (August-September, 1972).

[33]Mark L. Berman, "The Effects of the Magnitude of Response Cost and Reinforcement on Speed and Accuracy on Programming Materials" (Ph.D. dissertation, Arizona State University, 1969).

[34]Thomas G. Sticht, "Learning by Listening," Paper presented for C.O.B.R.E. Research Workshop on Language Comprehension and the Acquisition of Knowledge, Rougemont, North Carolina, March, 1971.

selection of instructional formatting is to be encouraged, preference for a particular format may not serve as well as measured ability in the prediction of success. This may be especially true in the primary grades.

Differential educational programming for individual learner characteristics seems to provide an effective and efficient avenue for instructional design. Faced with the practical constraints of schools today, homogeneous grouping of learners might be a starting point.

Auditory and Visual Modality Considerations

Much research has been conducted on the efficacy of audio, visual, and audio-visual presentations. Day and Beach analyzed thirty-four studies comparing visual and auditory presentations. From these, eleven generalizations were drawn. Those most pertinent to this study are presented:

1. Meaningful, familiar material is more efficiently presented aurally; meaningless, unfamiliar material is more efficiently presented visually.

2. The greater the intelligence of the receiver, the greater the relative advantage of a visual presentation.

3. The greater the reading ability of the receiver, the relatively more effective a visual presentation.

4. The relative efficiency of a visual presentation increases with age. At the age of six, a visual presentation is less effective than an aural presentation. At the age sixteen, a visual presentation may be more effective than an aural presentation.

5. Material that is organized and related--such as prose or factual information--is better understood with an auditory presentation; material that is comparatively discrete and unrelated--such as a code--is more effectively received with a visual presentation.

6. The comprehension of material can be tested either by the ease with which the material is learned or by the amount that is retained after a period of time. As a rule, measures of learning tend to favor a visual presentation, while measures of retention are higher after an auditory presentation.[35]

Edling and Paulson, in reviewing the literature of learning modalities and instructional media report the findings of Fairbanks, et. al.:[36]

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[35]Willard F. Day and Barbara R. Beach, "A Survey of the Research Literature Comparing the Visual and Auditory Presentation of Information," A. F. Technical Report No. 5921, November, 1950.

[36]Jack V. Edling and C. F. Paulson, "Understanding Instructional Media," The Contribution of Behavioral Science to Instructional Technology, Oregon: Teaching Research, A Division of the Oregon State System of Higher Education, IV-1:17-18.

> The audio-visual mode was superior to both (either audio or visual), suggesting that the individual differs in capability to handle one or the other mode of presentation, i.e., some people are better able to comprehend materials by one or the other modality, and the individual's preferred mode of receiving information was used in the audio-visual presentation. It does appear to be an individual difference factor in the capability to use either auditory or visual modes of presentation.

Basing his conclusions upon Miller's[37] theory of finite limits to channel capacity, Travers states:

> . . . the evidence indicates that multiple sensory modality inputs are likely to be of value only when the rate of input of information is very slow. The common practice of filling both the audio and the visual channels with a continuous flow of information would seem to have little support, except perhaps that it may satisfy some of the compulsions of film producers.[38]

The debate over single modality versus multiple modality presentations will probably continue for a time. Each modality has its own special applications for instruction. A summary statement from Edling and Paulson reflects the focus of this research:

> . . . the issue is no longer audiovisual versus audio versus visual, but what is the optimum rate for presenting information to learners of various capacities regardless of the modality employed.[39]

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[37]G. A. Miller, "The Magic Number 7, Plus or Minus Two: Some Limits on Our Capacity to Process Information," Psychological Review, 1956, 63, pp. 81-97.

[38]U.S., Department of Health, Education, and Welfare, "Research and Theory Related to Audiovisual Information Transmission," by R. M. W. Travers, Contract No. 3-20-003, Revised Edition, 1967, p. 267.

[39]Jack V. Edling and C. F. Paulson, op. cit., IV-1:14.

Rate-Altered Instruction

Rate-altered speech is the accelerating or decelerating of the rate of presentation of auditory information with little decrease in vocal pitch and quality. The regulation of the rate of presentation of auditory information may be used to accommodate the needs and abilities of the listener.

To illustrate, Taylor suggested that children recognize words auditorially much more quickly than they do visually until about grade six.[40] These figures were based on an average adult speaking rate of approximately 175 to 185 words per minute. Technologically, devices exist to increase the rate of presentation and further accentuate this gap. Instruction matched to this apparent auditory strength is truly of an advantaged nature.

The auditory presentations for purposes of this study were varied over three separate rates. One was presented at an expanded rate (95 w.p.m.); one at normal (125 w.p.m.); and one at a compressed rate (175 w.p.m.) to each of the subjects. The relatively simple regulation of the rate of presentation intended to accommodate individual difference variables among the learners.

Research has focused on many personological variables of listeners to determine their relationship with

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[40]Taylor's findings appear in Table 2.3 of this chapter.

comprehension of rate-altered speech. Fairbanks and others,[41] Sticht,[42] and Woodcock and Clark,[43] investigated mental ability and its relation to comprehension of compressed speech. As might be expected, comprehension of compressed speech generally increases as does mental ability. Rossiter[44] investigated sex differences in the comprehension of compressed speech. He examined both the sex of the listener and the sex of the speaker. No significant differences were found.

Gropper investigated the interaction of subject characteristics with performance at different levels of speech compression in an effort to isolate a set of predictor variables. He found large individual differences indicating that there is not one most efficient speed for everyone. He states, "In most cases, however, a speed much slower than

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[41]G. Fairbanks, N. Guttman, and M. Miron, "Auditory Comprehension of Repeated High-Speed Messages," Journal of Speech and Hearing Disorders 22 (1957): 20-22.

[42]Thomas G. Sticht, "Some Relationships of Mental Aptitude, Reading Ability, and Listening Ability Using Normal and Time-Compressed Speech," Journal of Communication 18 (1968): 243-258.

[43]R. M. Woodcock and Charlotte Clark, "Comprehension of a Narrative Passage by Elementary School Children as a Function of Listening Rate, Retention Period, and IQ," Journal of Communication 18 (1968): 259-271.

[44]Charles M. Rossiter, Jr., "Rate-of-Presentation Effects on Recall of Facts and of Ideas and on Generation of Inferences," Audio-Visual Communication Review 19, 3 (Fall, 1971): 313-324.

normal will not add much to comprehension, while speeds about twice as fast as normal will take too much away from comprehension to warrant their use."[45]

Woodcock summarized a series of interrelated studies pertaining to the application of rate-altered speech in the classroom. The series involved approximately seven hundred subjects over a period of two years. The subjects included normals, mental retardates, and the culturally disadvantaged. The Ss were drawn from grades 3 through 6, and from classrooms for adolescent mental retardates. Conclusions drawn by Woodcock pertinent to this study are as follows:

1. A pupil will achieve the highest score on a test over a passage at expanded rates of 75 to 125 words-per-minute.

2. A pupil's most efficient learning will take place at compressed rates of approximately 250 to 300 words-per-minute. (It is of interest to note that the normal speaking rate of 150 to 175 wpm provides neither the most effective rate nor the most efficient rate.)

3. In respect to the relationship of performance to intelligence, mental age is a very significant S variable.

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[45]Robert L. Gropper, "Comprehension of Narrative Passages by Fourth Grade Children as a Function of Listening Rate and Eleven Predictor Variables," Proceedings of the Second Louisville Conference on Rate and/or Frequency-Controlled Speech, Louisville, Kentucky, 1969, p. 252.

IQ, when mental age is held constant, does not seem to be an important variable.[46]

A pilot study undertaken in 1972, with emotionally disturbed children, measured the listening and reading comprehension of fifteen subjects using comparable forms of the STEP Listening Tests.

> A difference in comprehension in favor of listening was found for eight of the fifteen children in the class. For those who showed a better reading comprehension than listening comprehension, the average difference score was 13.86. For those who showed better listening comprehension than reading comprehension, the average difference score in favor of listening comprehension was 23.62. On the strength of these results, an effort was made to provide recorded texts for those whose listening comprehension was better than their reading comprehension. Although no formal assessment of the effects of this experiment has been attempted, their instructor is certain that their rate of educational progress has increased.[47]

In another study, Callaway, Gleason, and Klaeser measured subjects' listening skills before and after exposure to compressed speech by use of the STEP Listening Test. Their purpose was to examine the effects of exposure to compressed speech upon improvement of listening skills. They found no significant differences. It is interesting to note, however, that they made no attempt to examine differences in comprehension of rate-altered speech by those

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[46] R. M. Woodcock, "The Application of Rate-Controlled Recordings in the Classroom," Proceedings of the Second Louisville Conference on Rate and/or Frequency-Controlled Speech, Louisville, Kentucky, 1969, p. 100.

[47] Emerson Foulke, ed., and Michael Potters, Center for Rate-Controlled Recordings Newsletter, January 15, 1972.

having high listening skills and those with low listening skills as measured by the STEP.[48]

Rate-altered recordings have been used as an instructional medium in elementary schools on a limited basis. Goldhaber reports, ". . . evidence that perhaps we may be able to teach via compressed speech in the early grades of both elementary and secondary education."[49] Furthermore, Woodcock and Clark demonstrated that listening to compressed speech can be an effective learning medium for elementary school children.[50]

It appears that altering the rate of the presentation gives the educator some degree of flexibility in accommodating individual differences in the classroom. Consideration of the difficulty of content is an important factor. Although difficulty level of the material was not found to be significant by George[51] in his investigation, it nevertheless plays a role in comprehension. Taylor, for example,

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[48]Roland Callaway, Gerald Gleason, and Barbara Klaeser, "The Relationship of Listening Skills to the Utilization of Compressed Speech," Proceedings of the Second Louisville Conference on Rate and/or Frequency-Controlled Speech, Louisville, Kentucky, 1969, pp. 332-337.

[49]Gerald M. Goldhaber, "Listener Comprehension of Compressed Speech as a Function of the Academic Grade Level of the Subjects," Journal of Communication XX (June, 1970): 167.

[50]R. M. Woodcock and Charlotte Clark, op. cit., 1968, pp. 259-271.

[51]Robert Glen George, "Retention of Prose Material as a Function of Rate of Presentation and Difficulty of Material," AV Communication Review XVIII (Fall, 1970): 157.

reports that, "Considering that the average listener is exposed daily to speaking rates ranging from 135 to 175 words-per-minute, it appears that the listening mechanism readily adjusts to variation in rate of input, especially when the content is at or below the academic level of the listener. It is also quite probable that for short periods of time, considerably higher rates of presentation can be tolerated without a significant loss of retention, as long as the content is within the usual comprehension range of the listener."[52]

Rate-altered recordings have the potential for individualizing instruction especially when matched with learners demonstrating strengths in auditory reception. Foulke reports that equipment will soon be available allowing a learner to manage word rates for himself.[53] This device will take the form of an attachment to a standard cassette tape recorder. A financially affordable, technological innovation will then be ready for classroom applications. The rate of presentation will not be determined by a fixed outside source, but by the learner's own listening rate preference.

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[52]Stanford E. Taylor, op. cit., p. 12.

[53]Emerson Foulke, ed., Proceedings of the Second Louisville Conference on Rate and/or Frequency-Controlled Speech, Louisville, Kentucky, October 22-24, 1969, p. 2.

David Orr summarizes the future of this audio technology:

> The applied dimension lies in the realm of education. Today's pressures on education, created by the burgeoning knowledge and culture to be transmitted to the next generation, demand an efficient educational process. Each individual student likewise has a greater need for appropriate education to take a useful place in an increasingly complex and technical society. It is clear that auditory educational methods are assuming a larger and larger role in our educational process since some children learn better auditorially; since the use of audiovisuals is growing; and since the new educational technologies such as computer-assisted instruction, dial-access tape lectures, tele-lectures, etc., involve auditory presentations.[54]

Review of the Illinois Test of Psycholinguistic Abilities

The ITPA was conceived as a diagnostic rather than a classificatory tool. Its object is to delineate specific abilities and disabilities in children in order that remediation may be undertaken when needed.[55]

Based upon the communication model of Osgood,[56] the ITPA was first published in 1961 and revised to include twelve sub-tests in 1968. The revised edition was employed, in part, for this study.

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[54]David Orr, "A Perspective," Journal of Communication 18 (September, 1968): 291.

[55]Samuel A. Kirk, et. al., op. cit., p. 5.

[56]Charles E. Osgood, "A Behavioristic Analysis," Contemporary Approaches to Cognition (Cambridge, Mass.: Harvard University Press, 1957).

The present model upon which the ITPA is built includes three levels of cognitive abilities: (1) Channels of communication; (2) Psycholinguistic processes; and (3) Levels of organization. These dimensions are described by Krik, et. al., as follows:[57]

1. Channels of communication--These are the routes through which the content of communication flows. Included here are the modalities through which sense impressions are received.

2. Psycholinguistic processes--Three main processes are considered: (a) the receptive process, that is, that ability necessary to recognize and/or understand what is seen or heard; (b) the expressive process, that is those skills necessary to express ideas or to respond either vocally or by gesture or movement; (c) an organizing process which involves the internal manipulation of percepts, concepts, and linguistic symbols.

3. Levels of organization--The degree to which habits of communication are organized within the individual determines the level of functioning. Two levels are postulated in the clinical model of the ITPA: (a) the representational level, which requires the more complex mediating process of utilizing symbols which carry the meaning of an object; (b) the automatic level, in which the individual's habits of functioning are less voluntary but highly organized and integrated.

The model described has been used to generate twelve discrete tests for the purpose of assessing specific abilities and disabilities in children from the ages of two to eleven.

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[57]Kirk, et. al. op. cit., p. 7.

Descriptions of the Tests

Four tests of the ITPA were used in this study; they were:

1. Auditory reception--This is a test to assess the ability of a child to derive meaning from verbally presented material. Since the receptive rather than the expressive process is being sampled, the response throughout is kept at the simple level of a "yes" or "no" or even a nod or shake of the head. The test contains 50 short, direct items, such as "Do dogs eat?", "Do dials yawn?", "Do carpenters kneel?".

2. Visual reception--This test is comparable to the Auditory Reception Test, but uitlizes a different sense modality. It is a measure of the child's ability to gain meaning from visual symbols. In this test there are 40 items, each consisting of a stimulus picture on one page, and four response pictures on a second page. The child is shown the stimulus picture for three seconds with the directions, "See this?" Then the page of response pictures is presented with the directions, "Find one here."

3. Auditory Closure--This is basically a test of the organizing process at the automatic level. It assesses the child's ability to fill in missing parts which were deleted in auditory presentation and to produce a complete word. Auditory closure is an automatic function which occurs in everyday life in situations such as understanding foreign accents, speech defects, or poor telephone connections. In this test the the child is asked, "What am I talking about--bo/le? tele/one?" There are 30 items ranging in difficulty from easy words such as "airpla/" to more difficult ones such as "ta/le/oon" and /ype/iter."

4. Visual closure--This test assesses the child's ability to identify a common object from an incomplete visual presentation. There are four scenes, presented separately, each containing 14 or 15 examples of a specified object. The objects are seen in varying degrees of concealment. The child is asked to see how quickly he can point to all

> examples of a particular object with the time limit of 30 seconds for each scene.[58]

Research with the ITPA

The ITPA was used in this research as a tool to directly assign subjects to groups based upon strengths and weaknesses diagnosed in communication channels. Children demonstrating auditory strengths were assigend to an auditory group and children demonstrating visual strengths were assigned to a visual group. It is important, therefore, to provide evidence that the ITPA is able to differentiate in the communication channel dimension.

Burns and Watson recently factor analyzed the revised ITPA with underachieving children. Their subjects demonstrated marked academic learning problems not associated with mental retardation or sensory impairment, as did the subjects in this research. They concluded:

> There is definite evidence for the existence of two channels of communication, auditory-vocal and visual-motor; and such a concept as this would have practical implications for both individual programming and remediation as well as for regular classroom instructional procedures.[59]

A few studies have used the ITPA to identify perceptual strengths and weakness as the basis for grouping and

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[58]Descriptions of all ITPA subtests taken from Samuel A. Kirk, et. al., op. cit., pp. 9-12.

[59]Gary W. Burns and Billy L. Watson, "Factor Analysis of the Revised ITPA with Underachieving Children," Journal of Learning Disabilities 6, 6 (June/July, 1973): 41.

subsequent experimentation. Bateman,[60] divided subjects into auditory and visual learners after administering the experimental edition of the ITPA. An auditory method and a visual method were used with half of the students in each modality group. She concluded that the auditory method was significantly better for all groups. Her study, however, was met with some degree of criticism. The basis for grouping was determined by Psycholinguistic Age (PLA) scores rather than standard scores. The standard-score profile allows for meaningful comparisons across subscales; the PLA profile does not permit an interpretation of comparative strengths and weaknesses across subscales. Comparisons across subtests in a profile are meaningful only when the different subscales have equal variances. The standard score meets this criterion, but the PLA score does not.

Waugh tested 166 second graders with the Auditory Reception, Auditory Association, Visual Reception, and Visual Association tests of the ITPA. Children were grouped as auditory or visual learners based upon two levels of discrepancies represented by their scores. The more stringent criteria for grouping required that the mean score of the auditory tests be at least 12 standard score points above the mean of the two visual tests, (two standard deviations),

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[60]Barbara D. Bateman, "The Efficacy of an Auditory and a Visual Method of First Grade Reading Instruction with Auditory and Visual Learners," Perception and Reading (Newark, N. J.: International Reading Association, 1968).

in order for a child to be classified as an auditory learner. Less stringent criteria required a discrepancy of at least 6 standard score points. Approximately one-third (n = 54) of the population sampled were classifed as either auditory or visual leaners through this process. Visual and auditory instructional treatments were counterbalanced in the search for disordinal interaction. No disordinal interaction was found. There were, however, significant differences between groups at both levels of stringency for the auditory recall tasks. These differences demonstrated that auditory learners, as classifed by Waugh, did perform significantly better than did visual learners on an auditory recall task.[61]

Citing the usefulness of the ITPA as a tool for diagnosing perceptual and linguistic assets and deficits, de Hirsch, et. al., state, "We feel that exploration of modality strength and weakness is of more than theoretical interest and should largely determine teaching methods.[62] They conclude, "In our opinion, therefore, one method of teaching cannot be favored over another as a matter or principle. (Most discussions of the subject seem to miss this point.) Approaches to teaching should depend on the

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[61]R. P. Waugh, "Relationship Between Modality Preference and Performance," Exceptional Children 39 (March, 1973): 465-469.

[62]Katrina de Hirsch, Jeannette Jefferson Jansky, and William S. Langford, Predicting Reading Failure: A Preliminary Study (New York: Harper & Row, Publishers, 1966), pp. 82-83.

individual child's strengths and weaknesses in the different modalities."

Although the ITPA suffers from the criticisms and cautions accompanying most standardized tests, it seems to accomplish its primary objectives. Its underlying theoretical framework has its basis in the diagnostic-prescriptive teaching model. The ITPA is intended for use in identifying strengths and deficits extant in children.

Summary

While children in the primary grades spend a majority of their classroom time listening, there seems to be a lack of research on the systematic application of auditory channel instruction in the classroom.

It appears that listening and reading skills are strongly correlated. Many authorities, however, do not discount the notion that a child may have reading deficits and concurrent listening strengths.

Rate-altered recordings have been successfully applied to the primary grades with normal and exceptional children. The simple regulation of the rate of presentation has been used to individualize instruction. These recordings have been slowed for those needing more processing time, and accelerated for those needing less. Reading comprehension seems to be strongly related to the ability to comprehend compressed speech. Future investigations in

the area of rate-altered speech seem to have greatest potential when applied to classroom settings.

Many educators today emphasize advantaged instructional programs; that is, the assessment of a child's particular aptitudes followed by a matching of the mode of instruction to those aptitudes. Few educational technologists have been conducting research matching the properties of various media forms to learner characteristics. Concurrently, scholars indicate the great potential contributions of such forms of research.

The ITPA provides a diagnostic tool for identifying strengths and weaknesses in children. While it is not clear that the ten single abilities that the test hopes to identify are in fact separately measured, it does seem to measure communication channel differences.

The literature seems to indicate the need for applying existing educational technologies to diagnosed learner strengths.

CHAPTER III

DESIGN OF THE STUDY

The design of the study is presented in this chapter. This includes: (a) a description of the population and sampling procedures; (b) a description of the measures used to gather data from the sample; (c) the design matrix; (d) a statement of testable hypotheses; (e) analysis techniques used; and (f) a summary of the procedures.

The Population

The population under study in the research is generally termed "learning disabled." That is to say, a discrepancy exists between expected and actual academic achievement for these pupils not due to physical handicaps nor mental retardation.

Generally, the population fits this description by Bateman:

> . . . children who have learning disorders are those who manifest an educationally significant discrepancy between their estimated intellectual potential and actual level of performance related to basic disorders in the learning processes, which may or may not be accompanied by demonstrable central nervous system dysfunction, and which are not secondary to generalized mental retardation, educational or cultural deprivation, severe emotional disturbance, or sensory

> loss. Frequently these learning disorders seem to fit into one or more of three broad types--reading problems, visual-motor disturbance, and verbal communication disorders . . . .[1]

It should be emphasized that this population is not retarded, disturbed, or handicapped in the generalized sense. These children exhibit a normal range of intelligence. Discrepancies exist, however, between potential and performance.

More specifically, one of the three broad types identified by Bateman--children with reading problems--is of prime importance in this investigation.

A segment of this reading deficient population attends classes in a specialized learning center located in a large suburban school district. This school district is adjacent to a midwestern, urban, metropolitan area and draws from a broad range of socio-economic backgrounds and racial groups.

The learning center provides a remedial Language Arts program for approximately 100 elementary school students, divided evenly in half-day sessions. When not attending the center, students are mainstreamed into regular classrooms within the district.

The center is staffed by four professionals with training in the field of Learning Disabilities. Children

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[1]Barbara Bateman, "An Educator's View of a Diagnostic Approach to Learning Disabilities," Learning Disorders, Volume 1 (Seattle, Washington: Speical Child Publications, 1965), p. 220.

attend small classes, usually no more than twelve to fifteen per class. A para-professional is assigned to each classroom.

Criteria for admission to the learning center include the following:

1. The pupil should be two or more years behind his classmates in reading level according to a recognized standardized test, such as the Stanford Achievement Test or the Gates-MacGinitie Diagnostic Reading Survey.

2. A child who belongs in a special education class is not suitable for the learning center, although children with less serious physical, psychological, or social difficulties are readily accepted.

3. Children who are seeing several other specialists, such as speech therapists and social workers, or have a disjointed school day which would preclude success at the learning center should not be assigned to the learning center.[2]

Taking the Sample

The sample for this investigation was taken from that population of elementary children attending classes at the learning center. The center was chosen as the experimental site for two reasons:

1. The center is one of only two in the state specializing in remediating reading deficits. Thus, access to a relatively large and relatively homogeneous group was available.

2. This specific research was undertaken as part of a larger, ongoing investigation at the center. Thus, the cooperation of parents,

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[2]From a directive of the Office of Student Services, Waverly Public Schools, October 8, 1973.

pupils, staff, and administrators was more readily gained.

The sample for this study was taken from the first, second, and third academic grade levels in the center. Subjects ranged in age from seven through ten years. The fourth grade level was omitted for two reasons:

1. Chronological ages of the fourth level students were above the norms of the testing instrument used to determine sample groups.

2. The academic grade level of students served primarily as a blocking variable in this study. That is to say, division of the sample by grade level was used to increase precision through an accommodation of developmental differences in subjects by grade level. An adequate number of subjects were found in grades one through three.

An initial examination of health records for these primary students assured that those subjects who might comprise the sample possessed auditory and visual faculties within a normal range. This screening procedure left 78 primary pupils for application of the sampling instrument.

Subsequently, four subtests of the Illinois Test of Psycholinguistic Abilities (ITPA) were administered individually to determine sample subsets. These were: Auditory reception, Auditory Closure, Visual Reception, and Visual Closure. Administrators of the subtests were trained by a qualified, experienced examiner before the testing phase was begun.

The ITPA was standardized on a sample of 962 normal children. Test-retest coefficients of reliability for four, six, and eight year old children are provided by the authors. Table 3.1, below, provides reliability data for the eight year age group.

TABLE 3.1.--Five-Month Stability Coefficients for the ITPA Scores for Eight Year Old Children.[a]

Auditory Reception	.63
Auditory Closure	.71
Visual Reception	.66
Visual Closure	.82

[a]J. N. Paraskevopoulos and S. A. Kirk, The Developments and Psychometric Characteristics of the Revised Illinois Test of Psycholinguistic Abilities (Urbana, Illinois: University of Illinois Press, 1969), p. 108.

The stability coefficients given in Table 3.1 were based on data from eight year old subjects in the standardization sample. These age group norms, of the three given by the test's authors, are the most representative of the ages of sample subjects in this research.

The four subtests were selected from the composite ITPA (12 subtests) to differentiate intraindividual abilities in the auditory and visual communication channels. It was important, then, that the obtained difference scores between subtests for the same individual be reliable. Median

reliabilities for difference scores between the subtests used across all age levels are presented in Table 3.2, below.

TABLE 3.2.--Median Internal Consistency Coefficients for Difference Scores among Four ITPA Subtests.[a]

	Visual Reception	Auditory Closure	Visual Closure	Composite
Auditory Reception	.88	.84	.79	.84
Visual Reception		.82	.74	.82
Auditory Closure			.73	.82
Visual Closure				.68

[a]J. N. Paraskevopoulos and S. A. Kirk, The Developments and Psychometric Characteristics of the Revised Illinois Test of Psycholinguistic Abilities (Urbana, Illinois: University of Illinois Press, 1969), p. 11.

The subtests selected were representative of the composite ITPA. Two channels of communication were tapped --auditory and visual. Both the representational and automatic levels of organizing communication by the individual were measured by these tests. Finally, the means and standard deviations of these four subtests, as with all subtests of the composite ITPA, are equal; 36 and 6, respectively. A standard (scaled) score profile in the test manual was used to provide meaningful comparisons across subtests.

Subjects were directly assigned to either auditory or visual groups on the basis of test results. Either one of two criteria were applied in making this assignment. First, if a subject's mean score on the two auditory subtests was at least six standard (scaled) score points above his mean score on the two visual subtests, he was assigned to an auditory group. For example, Student X receives the following scaled scores on the four subtests: Auditory Reception--43; Auditory Closure--46; Visual Reception--38; and Visual Closure--36. These scaled scores yield an auditory mean of 44.5 and a visual mean score of 37.0, with a difference of 7.5. Thus, according to Criterion one, this subject was assigned to an auditory group. Visual groups were built conversely. A similar criterion was used by Waugh, in 1973.[3]

Secondly, differences between the mean scaled score of all four subtests and the scaled score of any particular subtest constituted a discrepancy if the magnitude of that difference was seven or more points. To illustrate, Student Y receives the following scores on the four subtests: Auditory Reception--27; Visual Reception--25; Auditory Closure--27; and visual Closure--40. The mean of all scaled scores, in this case is 29.75. The difference between this

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[3]R. P. Waugh, "Relationship Between Modality Preference and Performance," Exceptional Children 39 (March, 1973): 465-469.

mean of all scaled scores and the scaled score for the Visual Closure subtest is 10.25, indicating a visual strength. In this instance, Student Y is assigned to a visual group. Auditory groups were built in a conversely similar manner. This criterion is recommended for determining discrepancies in psycholinguistic functions by the test's authors.[4]

Some subjects were assigned to groups in an opposite direction to measured deficits. For example, if a subject's mean scaled score were 35, and a visual subtest score of 24 were recorded, the subject would be assigned to an auditory group. Strengths, in this case, are assumed to be those abilities that are not diagnosed as deficits.[5]

The ITPA subtests were administered to 78 students, one at a time, for approximately 30 minutes each. Those subjects not exhibiting discrepancies according to the aforementioned criteria were rejected from sample inclusion. Next, the remaining subjects were assigned to either an auditory or visual group, depending upon strengths measured. Each group was then broken into grade levels; grades one, two, and three, respectively. Finally, an equal number of subjects at each grade level was obtained by discarding those subjects with the lowest intraindividual

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[4]S. A. Kirk, et. al., Examiner's Manual, ITPA, 1968, p. 95.

[5]ITPA Scores for the sample appear in Appendix A.

discrepancies. To illustrate, if according to Criterion one the mean score difference between auditory and visual subtests were to be six scaled score points or more and to ensure equal cell size one subject needed to be discarded, the subject in that cell with the lowest mean difference score was dropped.

The sampling process identified fifteen auditory and fifteen visual subjects for a total sample size of thirty. The auditory and visual groups were further divided into grade levels (one, two, and three) with five subjects at each level.

Design

This research was of a quasi-experimental design.[6] Multiple measures were administered. Each was followed by a post-test. This appears graphically in Figure 3.1, below.

AUDITORY $X_1O_1X_2O_2X_3O_3$

VISUAL $X_1O_1X_2O_2X_3O_3$

Figure 3.1.--Procedural Design Over Time.

The three X's represent exposure to the experimental variable, rate of presentation. The 0's are post-tests. The

[6]Donald T. Campbell and Julian C. Stanley, Experimental and Quasi-Experimental Designs for Research (Chicago: Rand McNally & Co., 1963).

dashed line indicates that the two experimental groups, auditory and visual, were not randomly assigned. Subjects were directly assigned from ITPA results as previously described. Since subjects were not randomly assigned to groups, their selection was considered as a threat to internal validity. Therefore, an Analysis of Covariance was used to accommodate initial differences between groups. The covariate was reading comprehension, measured by the Gates-MacGinite Reading Tests Primary Forms A through C. Reading comprehension was found to be a significant subject variable in the comprehension of compressed speech by Mullaly, in 1972.[7] That is, those subjects with higher reading achievement level scores were significantly more able to comprehend compressed speech. It was controlled for in this research to better equate the groups.

The Gates-MacGinite Reading Tests had been administered district-wide as part of a state assessment program while this study was underway. Thus, scores were readily available from subjects' files. Standard scores of reading comprehension were used as the covariate. The Comprehension Test, according to the authors, ". . . measures the student's ability to read complete prose

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[7]Lee J. Mullaly. "Comprehension of a Narrative Passage by Primary School Children as a Function of Listening Rate and Reading Comprehension Level" (Ph.D. dissertation, Michigan State University, 1972).

passages with understanding."[8] Alternate form reliabilities for each form of the test administered appear in Table 3.3 below.[9,10]

TABLE 3.3.--Gates-MacGinite Reading Comprehension Reliabilities.

Primary A	.83
Primary B	.81
Primary C	.87

A concern for external validity arose from what might be termed multiple-treatment interference. This may occur if the effects of an earlier treatment are still present when the subject encounters a subsequent treatment. Often called carry-over effects, they were controlled by systematically ordering the presentation of the recorded listening passages. Table 3.4 illustrates on the following page.

In this manner, three listening passages were presented to subjects; and, each was prerecorded at an expanded, a normal, and a compressed rate. When presented according

[8]Arthur I. Gates and Walter H. MacGinite, Teacher's Manual, Gates-MacGinite Reading Tests (New York: Teacher's College Press, Columbia University, 1965), p. 1.

[9]Ibid., Technical Manual, p. 8.

[10]Gates-MacGinite Reading Comprehension Scores for the sample appear in Appendix B.

TABLE 3.4.--Orders of Presentation.

Expanded			Normal			Compressed		
Tape			Tape			Tape		
1	2	3	1	2	3	1	2	3
A	B	C	C	A	B	B	C	A
F	E	D	E	D	F	D	F	E

to the schedule in Table 3.4, no subject in a cell was given the same passage at the same rate.

Design Matrix

The design matrix took the form of a two-way, fully crossed design having a single repeated measure. Equal numbers of observations were made in all cells. The design variables were Type of Learner and Academic Grade Level. Academic Grade Level was used primarily as a blocking variable to increase precision. The repeated measure variable was Word Rate. The dependent variable was Listening Comprehension measured by a modified cloze test following each exposure to the rate-altered listening passages. The design matrix appears in Figure 3.2 on the following page.

Two analysis techniques were used to examine the data. An Analysis of Covariance was employed to investigate the effects of the design variables--Type of Learner and Academic Grade Level. Reading comprehension served as

Type of Learner	Grade Level	WORD RATE: Expanded 30%	Normal	Compressed 30%
Auditory	1st	s_1 . . . s_i		
	2nd	s_{i+1} . . . s_{2i}		
	3rd	s_{2i+1} . . . s_{3i}		
Visual	1st	s_{3i+1} . . . s_{4i}		
	2nd	s_{4i+1} . . . s_{5i}		
	3rd	s_{5i+1} . . . s_{6i}		

Figure 3.2.--Design Matris over Variables.

the covariate to accommodate initial differences between groups. To examine the effects of the repeated measure variable, Word Rate, an Analysis of Variance was employed. This analysis technique is suggested by Winer for examining the effects of a single repeated measure.[11]

Hypotheses

The ability of learning disabled, primary school children to comprehend rate-altered instruction was measured by a modified cloze test. The following was hypothesized:

Type of Learner Main Effect

Null Hypothesis: No difference will be found in comprehension of rate-altered instruction as measured by mean modified cloze test performance between auditory and visual groups.

Alternate Hypothesis: The mean score of the auditory group will exceed that of the visual group in comprehension of rate-altered instruction as measured by a modified cloze test.

Grade Level Main Effect

Null Hypothesis: No difference will be found in comprehension of rate-altered instruction as measured by mean modified cloze test performance between first, second, and third academic grade levels.

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[11] B. J. Winer, Statistical Principles in Experimental Design (New York: McGraw-Hill Book Co., Inc., 1962), p. 614.

Alternate Hypothesis: Third grade mean scores will exceed second grade mean scores, which in turn will exceed first grade mean scores in comprehension of rate-altered instruction as measured by a modified cloze test.

Word Rate Measure
Main Effect

Null Hypothesis: No difference will be found in comprehension of rate-altered instruction as measured by mean modified cloze test performance between expanded, normal, and compressed word rates.

Alternate Hypothesis: The expanded rate mean score will exceed the normal rate mean score, which in turn will exceed the compressed rate mean score in comprehension of rate-altered instruction as measured by a modified cloze test.

Interaction

Null Hypothesis: There will be no Type of Learner by Word Rate Measure interaction.

Alternate Hypothesis: There will be a Type of Learner by Word Rate Measure Interaction.

Stimulus Material

Three listening passages of approximately 100 words each were selected for use in the study. Passage One was taken, by permission, from the Reading Progress Scale by Ronald P. Carver.[12] Passages Two and Three were excerpted

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[12]Ronald P. Carver, Manual for the Reading Progress Scale (Silver Spring, Maryland: Revrac Publications, 1971).

from a story in basal reader.[13] An experienced announcer recorded the passages and a set of introductory statements for presentation to the subjects. All recording and duplicating was done with professional quality equipment in the Great Lakes Region Special Education Instructional Materials Center at Michigan State University.

A rate of approximately 125 words per minute was chosen as the normal rate for the passages. All expansion and compression was done from this base rate. The nature of the population influenced the selection of this base rate; that is, learning disabled primary school children. Additionally, Carver and others used a similar normal rate in recent compressed speech research.[14]

Each original recording was expanded and compressed approximately 30% with a Lexicon Varispeech I and duplicated in cassette form. This process yielded nine cassette tapes: three different passages at the normal rate; an expanded version of each passage; and a compressed version of each passage.

Demographic data for each listening passage appears in Table 3.5 on the following page. Original recorded rates

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[13]Patricia K. Miller and Iran L. Selegman, "Kangaroos," in Sounds of Laughter by Bill Martin, Jr. (New York: Holt, Rinehart & Winston, Inc., 1966), pp. 107-120.

[14]Ronald P. Carver, Raymond L. Johnson, and Herbert L. Friedman, "Factor Analysis of the Ability to Comprehend Time-Compressed Speech," Journal of Reading Behavior 4, 1 (Winter, 1971-72): 40-49.

are shown, as well as those for an approximate 30% compression and expansion.

TABLE 3.5.--Listening Passage Rates.

	Total Words	Normal Time (Sec.)	Normal WPM	Expanded Time (Sec.)	Expanded WPM	Compr. Time (Sec.)	Compr. WPM
Passage One	102	49.5	123.6	64.0	95.6	35.3	173.4
Passage Two	104	50.5	123.6	65.1	95.8	35.9	173.8
Passage Three	100	48.9	122.7	63.1	95.1	34.7	172.9

Comprehension Measures

Prior to its use, each listening passage was scaled for readability by the Fry Readability technique.[15] Each passage selected was found to be appropriate for a primary audience--approximately at the third grade level. This procedure was used to provide continuity in the level of difficulty across all three passages. Although developed originally as a measure designed to evaluate reading, readability formulas can be applied to listening passages as well. Sticht reports:

> With regard to the difficulty level of the material, the reading and listening performance of both groups

[15]Edward B. Fry, "A Readability Formula that Saves Time," The Journal of Reading 11 (April, 1968): 577.

> declined as the difficulty of the material was increased. Thus, the readability formula appears to have been appropriate for scaling "listenability" also.[16]

Subsequently, a modified cloze test, termed reading-input, was developed for each passage. These reading-input measures were developed through a standardized algorithmic procedure created by Carver.[17] The purpose of the resulting comprehension instruments was to measure the ability of a subject to recall deleted portions of a listening passage.[18] Three reading-input measures, each consisting of twenty items, were produced. These were hand scored using a standard correction for guessing--rights minus wrongs.

Reliability coefficients were calculated for the measures developed with the Kuder-Richardson 21 formula. These are given in Table 3.6 on the following page.

Experimental Procedures

The repeated measure (a rate-altered listening passage followed by a comprehension measure) was administered on a one-to-one basis, at approximately 30 minutes per subject, in a listening carrel within a conference

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[16]Thomas G. Sticht, "Learning by Listening," op. cit., 1971, p. 5.

[17]Ronald P. Carver, "Revised Procedures for Developing Reading-Input Materials and Reading-Storage Tests, Washington, D.C.: American Institutes for Research, October 12, 1973 (manuscript).

[18]Comprehension measures appear in Appendix D.

TABLE 3.6.--Comprehension Test Reliabilities.

Grade	Passage		
	One	Two	Three
One	0.81	0.87	0.87
Two	0.81	0.92	0.92
Three	0.81	0.95	0.92

room in the learning center. Each subject received an initial set of introductory statements followed by the listening experience and an appropriate comprehension measure. The introduction and listening passages were presented by cassette tape through a Wollensak 2550 unit. AKG K-180 stereophonic headphones adapted to monaural were used by each subject.

A predetermined schedule of presentations (See Table 3.4) assured that each subject received a different passage at the expanded, normal, and compressed rates. This dictated a total of nine separate tapes of the original three passages. A tenth tape, at a normal rate, introduced the task to the subjects. This introductory tape explained the task, directed the adjustment of the volume of playback, and cautioned subjects to listen carefully.

Then, the experimenter told the subjects, "We are going to listen to three short stories. After you listen

to a story the first time, I'm going to read it to you again, but I'll leave some of the words out. You help me to fill in the missing words. Let's try this one for practice."

The experimenter than read the following sentence.

> Charles asked his mother for a nickel to buy an ice cream cone, but she said he could not have it.[19]

The experimenter then said, "Now, I'm going to read that sentence to you again, but this time I'll leave some words out. Help me fill in the missing words."

"Charles asked his . . . (pause) Was the next word dog or mother?" Student responds. "For a nickel to . . . buy or walk?" Student responds. "An ice cream cone . . . baby or but?" Student responds. "She said he could . . . not or of?" Student responds. "Have it."

When necessary, the process was repeated until each subject understood the task. The listening passages were then presented with an oral administration of the comprehension measure in the same manner as the demonstration. Expanded passages were presented first, followed by the normal rate, and then the compressed.

Analysis

Subjects' scores were hand-coded and keypunched into cards. These scores and that of the covariate of

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[19]Ronald P. Carver, Manual for the Reading Progress Scale (Silver Springs, Maryland: Revrac Publications, 1971). Used by permission.

reading comprehension were analyzed via the Michigan State University CDC 6500. An Analysis of Covariance (ANCOVA) program supported by the STAT. system directed the actual analysis for the design variables. An Analysis of Variance (ANOVA) program directed the actual analysis for the repeated measure variable. The hypotheses were tested at the .05 level of significance. Use of the Michigan State University computing facilities was made possible through support, in part, from the National Science Foundation.

Summary

This study took the form of a quasi-experimental design with a single repeated measure. Subjects were selected and assigned to two groups, auditory and visual, using the Illinois Test of Psycholinguistic Abilities to discern communication channel strengths. An Analysis of Covariance was used to control for initial differences using reading comprehension as the covariate. Academic grade level served as a blocking variable.

The hypothesis of major interest was that those subjects identified as auditory learners would be better able to comprehend rate-altered instruction than those identified as visual learners.

Each subject was presented a systematically varied sequence of expanded, normal, and compressed listening passages. Comprehension was measured by a modified cloze test

administered orally by the experimenter. An Analysis of Covariance was used to determine the effects of the design variables upon the dependent variable, Listening Comprehension. An Analysis of Variance was employed to determine the effect of the repeated measure variable, Word Rate, upon the dependent variable. Hypotheses were tested at the .05 level of confidence. Results are presented in Chapter IV.

CHAPTER IV

ANALYSIS OF RESULTS

The results of the study are presented in this chapter. Testable hypotheses are restated individually and findings obtained from the investigation are provided for each. A summary of results is provided in tabular form. A discussion follows to give a meaningful interpretation of the findings.

Results

Results of testing each hypothesis are presented below. Each hypothesis is stated in testable form and the findings are presented individually for each.

Type of Learner Main Effect

> Null Hypothesis I: No difference will be found in comprehension of rate-altered instruction as measured by mean modified cloze test performance between auditory and visual groups.

The Analysis of Covariance produced an F-ratio of 3.2733 for the Type of Learner main effect which was not significant at the .05 level of confidence. The null hypothesis, therefore, was not rejected.

Academic Grade Level
Main Effect

Null Hypothesis II: No difference will be found in comprehension of rate-altered instruction as measured by mean modified cloze test performance between first, second, and third academic grade levels.

The Analysis of Covariance produced an F-ratio of 2.7087 for the Academic Grade Level main effect which was not significant at the .05 level of confidence. The null hypothesis, therefore, was not rejected.

Word Rate Measure Main
Effect

Null Hypothesis III: No difference will be found in comprehension of rate-altered instruction as measured by mean modified cloze test performance between expanded, normal, and compressed word rates.

An Analysis of Variance produced an F-ratio of 0.9101 for the Word Rate Measure main effect which was not significant at the .05 level of confidence. The null hypothesis, therefore, was not rejected.

Type of Learner by Word
Rate Measure Interaction

Null Hypothesis IV: There will be no Type of Learner by Word Rate Measure interaction.

An Analysis of Variance produced an F-ratio of 0.7588 which was not significant at the .05 level of confidence. The null hypothesis, therefore, was not rejected.

Summary of Results

A summary of findings are provided in Tables 4.1 and 4.2.

TABLE 4.1.--Analysis of Covariance (ANCOVA) Results for Listening Comprehension Scores.

Source of Variation	d.f.	Mean Squares	F-Ratio	p
Between Types of Learners	1	57.7391	3.2733	0.0836
Between Academic Grade Levels	2	47.7790	2.7087	0.0879
Interaction Between Type of Learner and Academic Grade Level	2	3.8625	0.2190	0.8051
Error Term	23	17.6392		

N = 30

TABLE 4.2.--Analysis of Variance (ANOVA) Results for Listening Comprehension Scores.

Source of Variation	d.f.	Mean Squares	F-Ratio
Between Word Rate Measures	2	16.0444	0.9101
Interaction Between Type of Learner and Word Rate Measure	2	13.3778	0.7588
Interaction Between Academic Grade Level and Word Rate Measure	4	17.7111	1.0044
Interaction Between Type of Learner, Word Rate Measure, and Academic Grade Level	4	10.6444	0.6037
Error Term	48	17.6333	

N = 30

All hypothesis testing was done at the .05 level of confidence. No null hypothesis was rejected at this level.

Discussion

The result of the Analysis of Covariance between Type of Learner groups (Auditory and Visual) was not significant at the .05 level of confidence. The probability of the obtained F-ratio was .08. An inspection of the data in Tabel 4.2, below, reveals differences in the comprehension test mean scores according to learner type which are generally consistent with the hypothesized superiority of auditory groups to more readily comprehend rate-altered instruction. Thus, while significant differences were not found through an Analysis of Covariance, the data does suggest a difference not discernable in the F-test and which is not likely due to chance.

TABLE 4.3.--Comprehension Test Mean Scores and Standard Deviations by Type of Learner Groups According to Academic Grade Levels.

Grade Level	Aud. Mean	Aud. S.D.	N	Vis. Mean	Vis. S.D.	N
1	6.933	3.69	5	3.200	5.19	5
2	9.867	2.56	5	9.333	5.35	5
3	11.067	4.68	5	8.267	3.42	5

Sample N = 30

The generally ascending mean scores according to grade level further indicate a superiority for academically advanced students to more readily comprehend rate-altered instruction, as might be expected.

Reading Comprehension and Listening Comprehension

It is well substantiated that elementary students spend more classroom time listening than reading. That, in fact, children listen more than they read. A major contention of this thesis, however, is that some children may listen better than they read. If that were true, auditory instruction of an advantaged nature might be provided them.

An examination of the data from Table 4.4, below, provides some degree of support for the notion that some children listen better than they read.

TABLE 4.4.--Means and Standard Deviations of Listening and Reading Comprehension Measures by Type of Learner and Academic Grade Level.

	Auditory Group				Visual Group			
Grade Level	List. Mean	List. S.D.	Rdg. Mean	Rdg. S.D.	List. Mean	List. S.D.	Rdg. Mean	Rdg. S.D.
1	6.93	3.69	40.20	4.09	3.20	5.19	40.20	10.23
2	9.86	2.56	50.08	13.44	9.33	5.36	57.20	11.39
3	11.07	4.68	39.60	6.62	8.27	3.42	44.60	7.77

N = 30

Subjects with identified auditory strengths had greater observed mean scores in listening comprehension of rate-altered instruction than those subjects with identified visual strengths. At the same time, however, the reading comprehension scores measured by the Gates-MacGinite reading tests for the auditory group were lower, on the average, than those for the visual group. Thus, while the reading comprehension abilities of the auditory group were lower than or equal to those of the visual group, their listening comprhension abilities were greater in each case.

A Pearson product-moment coefficient of correlation between listening comprehension and reading comprehension was computed from the data. This revealed a rather low index of 0.271 for the sample.

Although listening skills and reading skills are no doubt strongly related, it appears that being a "poor" reader does not preclude being a "good" listener.

Word Rate

Altering the rate of presentation within a small range, approximately 90 to 175 words per minute, appeared to have little effect upon comprehension. In Table 4.5 on the following page, mean scores of learner groups at each of the rates are presented.

TABLE 4.5.--Mean Scores and Standard Deviations at Expanded, Normal, and Compressed Rates for Auditory and Visual Groups by Academic Grade Level.

	Auditory						Visual					
Grade Level	Exp.	S.D.	Norm.	S.D.	Comp.	S.D.	Exp.	S.D.	Norm.	S.D.	Comp.	S.D.
1	5.6	4.8	6.0	5.1	9.2	2.99	2.0	6.2	3.2	6.0	4.4	3.5
2	12.0	3.8	8.0	3.3	9.6	3.4	9.2	6.0	10.4	5.3	8.4	5.6
3	8.4	5.7	11.2	6.0	13.6	4.1	8.0	4.2	8.4	6.1	8.4	3.9

Auditory groups, however, did exhibit consistently larger observed mean scores at the expanded and compressed rates than did their visual counterparts. Furthermore, observed mean scores for auditory learners were higher at the compressed rate than at any other in all instances but one.

Summary

An Analysis of Covariance was used to test the hypothesis for Type of Learner and Academic Grade Level main effects. No significant differences were revealed at the .05 level of confidence. An Analysis of Variance was used to examine the Word Rate Measure main effect and Type of Learner by Word Rate Measure interaction. Again, no significant differences were revealed at the .05 level of confidence.

While significant differences were not found through the analysis procedures, a discussion was provided of suggested, observed differences not discerned by the F-tests.

A summary of testable hypotheses and statements of rejection appear in Table 4.6.

TABLE 4.6.--Summary of Results.

Null Hypotheses	Statement of Rejection or Non-rejection
I. No difference will be found in comprehension of rate-altered instruction as measured by mean modified cloze test performance between auditory and visual groups.	Non-rejection
II. No difference will be found in comprehension of rate-altered instruction as measured by mean modified cloze test performance between first, second, and third academic grade levels.	Non-rejection
III. No difference will be found in comprehension of rate-altered instruction as measured by mean modified cloze test performance between expanded, normal, and compressed word rates.	Non-rejection
IV. There will be no Type of Leaner by Word Rate Measure Interaction.	Non-rejection

Tested at the .05 level of confidence.

CHAPTER V

SUMMARY AND IMPLICATIONS

Summary

The major purpose of this study was to investigate the applicability of advantaged auditory instruction with learning disabled primary school children. Advantaged auditory instruction, in essence, implies that teaching to the learner's strengths and bypassing his deficits results in effective learning. The key notion underlying such a concept is that instruction be designed to capitalize upon individual strengths of learners. Deficits are not remediated directly.

To investigate this concept of advantaged auditory instruction, a sample of thirty learning disabled primary school children with reading problems were divided into two groups, auditory and visual, on the basis of identified communication channel strengths measured by the Illinois Test of Psycholinguistic Abilities. Each group listened to passages of connected discourse at an expanded, normal, and compressed rate of presentation. Each passage was followed by an oral administration of a cloze technique comprehension measure.

The cloze test had been modified by a standardized algorithmic procedure to provide subjects with two alternatives from which to choose in supplying deleted words. The hypothesis of major interest was that those subjects identified as auditory learners would be more able to comprehend rate-altered instruction than those identified as visual learners.

An Analysis of Covariance was used to control for initial differences in order to equate the groups formed through non-random assignment. Reading comprehension was used as the covariate. Academic grade level served as a blocking variable to increase precision. The design was two-way, fully crossed, with a single repeated measure. The two design variables, Type of Learner and Academic Grade Level, were analyzed with Analysis of Covariance.

The repeated measure variable of Word Rate and the interaction of Type of Learner and Word Rate Measure were analyzed by an Analysis of Variance. All hypothesis testing was done at the .05 level of confidence set prior to the experiment according to traditional educational research conventions.

Findings

Four major hypotheses were tested in the investigation. None were rejected at the .05 level of confidence. The obtained probability of the F-ratio for Type of Learner main effect and Academic Grade Level main effect was .08.

Conclusions

Based on the findings, since the null hypotheses could not be rejected, the alternative hypotheses could not be accepted.

Discussion and Recommendations

The findings of no significant difference were difficult to accept. The importance of the concept of advantaged auditory instruction as a potential tool was difficult to summarily dismiss.

Retrospective analysis indicates two potential sources of error on the part of the investigator which should be pointed out to others who would follow this path. First, there are the experimental factors which could, and should be reviewed if a second study of this nature were to be performed. Second, there is the experimental design itself--particularly the alpha level set to determine acceptance or rejection of the hypotheses.

Some experimental factors such as the small sample size immediately reveal a weakness in the discriminative power of the experiment. If this study were to be replicated with a larger sample, perhaps there could be a significant finding, even at the .05 level of confidence. The listening comprehension test itself was, and still remains, one of the weak features in any effort to investigate advantaged auditory instruction. The modified cloze, like

its predecessor the standard cloze procedure, seems less sensitive to large differences in understanding than other measures. The inability of this investigation to reveal significant differences at the .05 level of confidence may be due, in fact, to this insensitivity. The alternatives to researcher developed listening comprehension measures are limited, however. Future research endeavors with auditory instruction would certainly benefit from the refinement of existing listening comprehension instruments and the development of new techniques. The Illinois Test of Psycholinguistic Abilities was used to assign subjects to sample groups. Although the composite appears to be able to differentiate communication channel abilities adequately, only four of the twelve tests were used. Furthermore, the use of more stringent criteria for designating a subject as an auditory or visual learner might have resulted in more discrete grouping. Potentially, this procedure could have resulted in revealing significant differences. Finally, the rates of presentation were kept within a narrow range (Approximately 90 to 175 w.p.m.). If an additional compressed rate of 225 w.p.m. or higher were to be added, differences between auditory and visual groups might have become more apparent.

The selection of an alpha level of .05 in the initial stages of the study is viewed as the second major source of potential investigator error.

The convention of setting an alpha level at .05 or lower has grown from the desire to avoid the acceptance of educational research findings without a high degree of confidence in their "truth." This is most commendable in cases where decisions need to be made from a set of alternatives; some of which may hold dire consequences for the educational progress of children. A medical analogy is the investigation of a new drug prior to its introduction to the general public. To be sure, the consequences of deleterious side-effects need to be carefully considered and pre-introductory experimentation must be rigorous and stringent, indeed. Alpha levels, in this instance, may not be tolerable unless they are set at very low levels.

A second medical analogy, perhaps somewhat more closely related to the existing status of educational practice, is the case of the terminal cancer patient. In making decisions for the treatment of terminal patients, the alternatives may be many in number. The consequences of selecting any one of the alternatives for implementation, however, will certainly not have a more deleterious effect than to allow the status quo to exist; that is, to allow the disease to run its course. In this case, the amount of error that is tolerable is most certainly increased.

Children with reading problems, in effect, may be plagued with a terminal disease. To be unable to read

destines a child to a life of limited potential. Supplemental and alternative means of instruction are needed in addition to the status quo if, in fact, the terminal disease is to be arrested.

In retrospect, the selection of the .05 level of confidence appears to have been inappropriate for this investigation. The consequences of drawing implications from obtained probability levels under .10 seems to be outweighed by the consequences of accepting current educational practice in its entirety.

Implications

Given the context of the two sources of potential experimenter error, it is felt that the Preferential Model exemplified in the concept of advantaged auditory instruction cannot be summarily dismissed. Thus, the following series of implications for future research have been drawn. These are not conclusions. They are, rather, a set of observations in need of more conclusive investigation.

1. Learning disabled primary school children with identified auditory strengths generally appear to be more able to comprehend rate-altered instruction than those children with visual strengths. In this investigation, the obtained probability of the F-ratio for this Type of Learner main effect was .08. The area seems worthy of future research.

2. Past research has indicated that children in higher academic grade levels seem to be more able, generally, to comprehend rate-altered instruction than those children in lower academic grade levels. The obtained probability of the F-ratio in this investigation for the Academic Grade Level main effect was .088.

3. When the rates of auditory presentations are kept within reasonable and narrow limits (approximately 90 - 175 w.p.m.) their alteration tends to have little effect upon comprehension. If comprehension at faster rates is equal to comprehension at slower rates, then it appears that the compressed rate is preferable when learning per unit of time is a consideration.

4. Reading comprehension and listening comprehension ability correlated weakly (0.27) in this investigation. In predicting the success of rate-altered instruction with learning disabled primary children, a diagnosis of communication channel strength may serve as a stronger predictor variable. The area seems to be worthy of future research.

5. The Illinois Test of Psycholinguistic Abilities appears to be a viable tool for measuring communication channel strengths and weaknesses. It may be useful, therefore, in predicing success in advantaged instructional treatments matched to those strengths.

6. Auditory instruction in general, and rate-altered instruction in particular, are valuable educational tools for children with low reading skills. Although reading and listening seem to demand a somewhat similar set of skills, being a "poor" reader does not appear to preclude being a "good" listener.

7. It seems important that consideration of students' strengths and preferences be made before they are programmed into a lock-step instructional sequence. If such a philosophy is embraced, it is imperative that optional learning experiences be provided learners to ensure maximum success. If existing technologies and diagnostic techniques can successfully match students to programs, it seems far better to adapt such programs to students, rather than students to programs.

8. Learning disabled children in general, and those with reading problems in particular, are in great need of alternative methods of receiving instruction. It is not recommended that the development of reading skills be deemphasized, but, rather that advantaged instructional methodologies be researched and developed to provide instruction concurrent with remediational activities.

APPENDICES

APPENDIX A

SAMPLE SCORES FOR THE ITPA

APPENDIX A.--Sample Scores for the ITPA.

Student Number	Grade	Auditory Reception	Visual Reception	Auditory Closure	Visual Closure
			Auditory		
10	1	35	38	38	23
11	1	43	38	47	36
12	1	40	31	36	29
13	1	36	22	28	28
14	1	34	25	36	29
20	2	30	35	44	31
21	2	28	19	31	33
22	2	28	39	42	31
23	2	42	41	36	29
24	2	37	31	46	32
30	3	27	32	46	36
31	3	35	27	44	35
32	3	30	24	44	20
33	3	30	21	34	26
34	3	43	40	48	31
			Visual		
15	1	32	36	17	31
16	1	27	25	27	40
17	1	21	37	29	32
18	1	27	32	22	35
19	1	25	29	20	30
25	2	22	25	16	28
26	2	31	36	19	34
27	2	20	35	32	33
28	2	29	49	14	36
29	2	20	40	35	31
35	3	22	40	34	34
36	3	26	38	24	50
37	3	25	38	25	33
38	3	23	35	27	31
39	3	15	32	01	42

APPENDIX B

SAMPLE SCORES FOR GATES-MACGINITE

READING COMPREHENSION PRIMARY

FORMS A - C

APPENDIX B.--Gates-MacGinite Reading Comprehension Scores.

Student Number	Grade Level	Reading Comprehension Standard Score
	Auditory	
10	1	37
11	1	40
12	1	40
13	1	37
14	1	47
20	2	53
21	2	59
22	2	30
23	2	64
24	2	44
30	3	47
31	3	29
32	3	41
33	3	42
34	3	39
	Visual	
15	1	33
16	1	44
17	1	44
18	1	53
19	1	27
25	2	39
26	2	66
27	2	53
28	2	64
29	2	64
35	3	47
36	3	47
37	3	53
38	3	32
39	3	44

APPENDIX C

FRY READABILITY FORMULA

PROCEDURE FOR USING FRY'S READABILITY TECHNIQUE

1. Choose a passage from a book or basal reader (about 100 words in length). Book, page, and paragraph _____

2. Count the number of words in the selection. Words (W) = _____

3. Count the number of sentences in the selection. Sentences (S) = _____

4. Count the number of syllables in the selection. Syllables = _____

5. Substitute the above numbers in the following formulas:

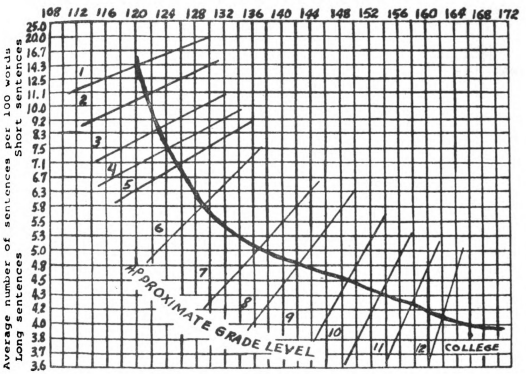
   Syllables per 100 words = $\frac{100 \text{ (Syllables)}}{W}$ =

   Sentences per 100 words = $\frac{100 \text{ (S)}}{W}$ =

6. Plot the two numbers on the graph below to find approximate grade level.

7. Approximate grade level is _____.

PROCEDURE FOR USING FRY'S READABILITY TECHNIQUE (Continued).



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READABILITY DATA

Passage One	102 Words	
	14 Sentences	13.72, 136
	139 Syllables	Third Level
Passage Two	104 Words	
	12 Sentences	11.5, 131.7
	137 Syllables	Third Level
Passage Three	100 Words	
	13 Sentences	13, 128
	128 Syllables	Third Level

APPENDIX D

CARVER READING-INPUT ALGORITHM

By following certain manual developmental procedures, the alternative words for a 30-item reading-input passage can be produced for a 150-word prose passage in about 15 minutes. These manual steps are as follows:

Step 1. Select the parameter, N_r, the size of the repetitive unit. For most research purposes, $N_r = 5$, the same as regular cloze.

Step 2. Select parameter, X_i, the location of the item within each repetitive unit.

Step 3. On the prose itself, mark out the correct word for each item. For example, if $N_r = 5$ and $X_i = 2$, then the second word in the prose should be crossed out, and then every fifth word thereafter should be crossed out.

Step 4. Write or type the remaining words on a page in a column with the $N_r - 1$ words between items typed on each row. Leave space at the right hand margin of the page for the items (i.e., $N_a + 1$ lines per item), and skip a line to designate a new paragraph.

Step 5. A random number table may be consulted to mark on the work sheet which of the word positions will contain the correct word. For example, odd numbers in a sequence of random numbers can be used to designate the upper position as containing the correct answer, and even numbers can be used to designate the lower position as containing the correct answer.

Step 6. Copying from the original prose, write in the correct words for each item on the work sheet in the position designated in Step 5.

Step 7. Select the parameter, N_p, which is number of words preceding and succeeding an item which are included as possible candidate alternatives. Select the exclusion conditions and the subsequent N_b, N_j, & N_c parameters as needed. The manual implementation of the steps is greatly facilitated when: (a) N_p is a multiple of N_r, (b) $N_b = N_r - 1$, (c) and $X_j = X_i$. For example, consider the Figure 2 example: (a) $N_p = 25$, and 25 is the multiple of 5, the N_r value, (b) $N_b = 4$, i.e., $N_r - 1$, so that the row of four words that the item is on is excluded as well as the following row of four words, (c) $X_j = 3$, i.e., $X_j = X_i$, so that all of the correct item words in the final column of items may be excluded.

Step 8. Assuming that the recommended parameter values in Step 7 are adopted, Step 8 involves three substeps. These substeps involve the use of a series of random numbers and they will be explained in concrete terms using the Figure 2 parameters as examples.

Substep 8A. Enter a table of random numbers and select a one digit number. If it is an odd numbered digit, the candidate word will be in the pool of words preceding the item. If the random number is an even numbered digit, the candidate word will be in the pool of words following the item.

Substep 8B. Inspect the subsequent one digit numbers in consecutive order until one of the digits 2, 3, 4 or 5 is found. This digit will designate the number of rows following or preceding the item wherein the candidate alternative word will be found. Row number 1 will always be excluded when $N_b = N_r - 1$. The upper limit number, 5 in this case, will always equal N_P / N_r.

Substep 8C. Continue to inspect the series of digits until one of the digits 1, 2, 3, or 4 is found. This digit will designate the order position of the candidate alternative word within the row. The above set of digits will always correspond to the number of words per row, i.e., 1 through $N_r - 1$.

Step 9. Check the candidate word for the item against the correct word (and any previously selected alternative word when $N_a > 1$) to see if it is the same word as the correct word. This is the first exclusion condition, E = 1. If a match results, then the candidate word is rejected, and another candidate word is chosen according to Step 8.

Step 10. Select the parameter, N_c. The manual implementation of this step is facilitated when $N_c = N_r - 1$, i.e., when the number of words preceding and following an item which cannot include the same word as the alternative word is equal to the number of words in the same row and the following row.

Step 11. Assuming that the parameter value recommended in Step 10 is adopted, Step 11 involves a comparison between the candidate word and each word in the same row as the item and the row following the item. If the word matches one of these words, then it is rejected and another candidate word is chosen according to Step 8. If the word does not match any of these words then this word becomes an alternative word, and it is written in on the work sheet in the proper blank. The alternative word is capitalized whenever the correct word is capitalized, and when the correct word is not capitalized then the alternative word is not capitalized.

The remaining alternative words are chosen according to the same procedures, i.e., according to Steps 8 and 9 using the same parameter values as were used for the first alternative word.

APPENDIX E

PASSAGES AND MEASURES

INTRODUCTION

Hello there! Now that you have your earphones on, I will talk for a while so that you can adjust the volume, if you need to.

We are going to listen to three short stories. They are very short, so listen carefully. When each story is over, you will be asked some questions. Try hard to listen well.

My voice is going to sound different for each story. So, even if it sounds strange to you, listen carefully. It's supposed to sound that way.

PASSAGE ONE

This is our Post Office. It is in our city. Many people work here. There is a Post Office in every city in our country. And Post Offices in every country in the world.

A Post Office helper must be honest. He must be a good worker. A Post Office helper handles lots of mail. A Post Office helper handles lots of money.

The Post Office sends letters and packages, magazines, and newspapers all over the world. It sends small animals and plants, too. It sends money for use. It saves money for us. It puts money to work for us, too.

MEASURE ONE

This is ☐ country ☐ our Post Office. It is ☐ there ☐ in our city. Many people ☐ post ☐ work here. There is a ☐ Post ☐ Be Office in every city ☐ is ☐ in our country. And Post ☐ good ☐ Offices in every country in ☐ the ☐ city world.

A Post Office ☐ helper ☐ in must be honest. He ☐ handles ☐ must be a good worker. ☐ Every ☐ A Post Office helper handles ☐ lots ☐ and of mail. A Post ☐ animals ☐ office helper handles lots of ☐ and. ☐ money.

The Post Office sends ☐ worker ☐ letters and packages, magazines, and ☐ helper ☐ newspapers all over the world. ☐ It ☐ Helper sends small animals and ☐ plants, ☐ all, too. It sends money ☐ for ☐ office us. It saves money ☐ sends ☐ for us. It puts money ☐ to ☐ and work for us too.

PASSAGE TWO

Do you know where baby kangaroos live? They live in their mother's "pocket." All baby kangaroos are called joeys. The mother kangaroo carries her joey with her, in her pocket.

A baby kangaroo is only one inch long when it is born. It has no fur. It cannot see. As soon as it is born, it crawls into the pocket.

The baby kangaroo stays in the pocket for four months. The pocket keeps it safe and warm. The mother makes milk in her body to feed the joey. If you could look in the pocket, you would see how much bigger it is growing.

MEASURE TWO

Do you ☐ know ☐ their where baby kangaroos live?

☐ With ☐ They live in their mother's ☐ her ☐ pocket. All baby kangaroos are ☐ called ☐ her Joeys. The mother kangaroo ☐ carries ☐ is her Joey with her ☐ in ☐ fur her pocket.

A baby ☐ with ☐ kangaroo is only one inch ☐ long ☐ the when it is born. ☐ See ☐ It has no fur. It ☐ Joey ☐ cannot see. As soon as ☐ it ☐ the is born it crawls ☐ fur ☐ into the pocket.

The baby ☐ kangaroo ☐ no stays in the pocket ☐ it ☐ for four months. The pocket ☐ keeps ☐ body it safe and warm.

☐ The ☐ Look mother makes milk in ☐ her ☐ months body to feed the ☐ Joey ☐ much. If you could look ☐ growing ☐ in the pocket, you would ☐ feed ☐ see how much bigger it is growing.

PASSAGE THREE

Kangaroos live together in small groups. A group of kangaroos is called a mob. The strongest male kangaroo is the leader of the mob. He had to fight the other male kangaroos to become the leader. He had to show that he was the strongest kangaroo. He had to show that he could take care of the mob.

Kangaroos sleep during the day. At night they move about, looking for food. Kangaroos eat grass. They nibble leaves from small trees. They eat fruit and vines.

A kangaroo has a long, heavy tail. It rests on its tail when it sits.

MEASURE THREE

Kangaroos live ☐ together ☐ had in small groups. A ☐ group ☐ he of kangaroos is called ☐ live ☐ a mob. The strongest male ☐ that ☐ kangaroo is the leader of ☐ small ☐ the mob. He had to ☐ fight ☐ strongest the other male kangaroos ☐ is ☐ to become the leader. He ☐ had ☐ other to show that he ☐ was ☐ they the strongest kangaroo. He ☐ they ☐ had to show that he ☐ sleep ☐ could take care of the ☐ mob ☐ food.

Kangaroos sleep during the ☐ he ☐ day. At night they move ☐ about ☐ leaves looking for food. Kangaroos ☐ during ☐ eat grass. They nibble leaves ☐ care ☐ from small trees. They eat ☐ fruit ☐ sleep and vines.

A kangaroo ☐ rests ☐ has a long, heavy tail. ☐ Food ☐ It rests on its tail ☐ they ☐ when it sits.

APPENDIX F

COMPREHENSION TEST SCORES FOR THE SAMPLE

APPENDIX F.--Comprehension Test Scores for the Sample.

Student Number	Expanded	Normal	Compressed
	Auditory		
10	2	2	12
11	14	14	12
12	2	10	4
13	8	2	10
14	2	2	8
20	18	10	12
21	8	12	8
22	12	4	4
23	14	10	10
24	8	4	14
30	12	4	10
31	4	18	18
32	16	16	14
33	0	4	8
34	10	14	18
	Visual		
15	2	2	4
16	- 2	8	6
17	- 2	- 4	- 2
18	14	12	8
19	- 2	- 2	6
25	2	4	2
26	8	4	2
27	14	14	12
28	18	16	10
29	4	14	16
35	12	4	10
36	10	10	4
37	2	18	14
38	12	10	10
39	4	0	4

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