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Verbal Sequencing Ability as a Predictor of Reading Disability

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AN ABSTRACT OF THE THESIS OF Paul Elmer Quin for the Master
of Science in Speech: Emphasis in Speech Pathology/
Audiology presented May 4, 1973.

Title: Verbal Sequencing Ability as a Predictor of Reading
Disability.

APPROVED BY MEMBERS OF THE THESIS COMMITTEE:

Robert H. English, Chairman

Robert W. Blakeley

James F. Maurer

Walter F. Thomas

Early identification of children with reading and learning problems seems imperative. By using early identification predictors, a high risk group of children with possible reading problems could be located. This would facilitate placement and appropriate educational strategies for this group of children. By proper placement and planning, educators then would be able to set up remedial

and/or preventive programs for these children before the pattern of unsuccessful attempts and improper training becomes irreversible.

This study was designed to determine if verbal sequencing ability was a valid predictor of reading ability for a group of 31 preschool children. Secondly, the investigation attempted to determine whether such verbal sequencing ability was predictive of general academic ability for this group of children. Reliability of the Blakeley Verbal Sequencing Ability Tests was determined.

Thirty one children who were originally tested for verbal sequencing ability in 1965 when they were five years old were located in the Portland Public Schools. The children, now 13 years old, were administered the Blakeley Verbal Sequencing Ability Tests and the Gilmore Oral Reading Test. Records of school achievement were obtained from each child's cumulative school file.

A least squares linear regression equation was used to analyze the data obtained. When the predictive value of the original verbal sequencing score was studied in relation to reading accuracy, reading comprehension, and general academic achievement, results for the total group of 31 children were not promising. Verbal sequencing ability in preschool children, in general was not significantly predictive of reading accuracy, reading comprehension, and school achievement eight years later.

Examination of the results obtained on the Blakeley Verbal Sequencing Ability Tests by Blakeley and this investigator suggested that interexaminer reliability is extremely high.

The most significant finding of this study was found through a comparison of the results of the male and female groups. The original sequencing score was a much better predictor of reading ability and school achievement for the males. The correlations were higher in all three areas: comparing original sequencing ability with reading accuracy, reading comprehension, and school achievement. This trend may indicate that the sequencing test was not discriminative enough for five year old females, due to the advanced rate of physical and neurological development at that age. More significantly, the children used in this follow-up study may not have been representative of the original group tested, due to problems in locating the original subjects.

VERBAL SEQUENCING ABILITY
AS A PREDICTOR
OF READING DISABILITY

by

PAUL ELMER QUIN

A thesis submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE
in
SPEECH: EMPHASIS IN SPEECH PATHOLOGY/AUDIOLOGY

Portland State University
1973

TO THE OFFICE OF GRADUATE STUDIES AND RESEARCH:

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Statistical computations were directed by Dean Clarkson, Ph. D., of Portland State's School of Social Work. His aid and explanations of statistical tabulations and theories helped me immensely.

Entrance into the public schools could have proved to be a great barrier to this study. Mrs. Ruth Peets, Specialist in Speech, Portland Public Schools, however, eased this problem by offering her services for location of the subjects. I am deeply indebted to her and to the principals of Abernathy, Buckman, Columbia, Hosford, Kellogg, Lane, Whitaker, and Woodstock schools for their time and cooperation with this study.

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CHAPTER I

REVIEW OF LITERATURE AND STATEMENT OF PROBLEM

Introduction

The educational handicaps faced by a reading disabled child can impede his total academic career. Throughout the history of research in education, educators have tried to discover correlates and/or predictors of reading disability. An accurate prediction of disability in this area would enable early detection and possible remediation for this group of children. Alternate strategies and curriculum changes might enable such children to gain a more enriched education.

It has been accepted generally that intelligence may be a factor related to reading, yet there remains a large group of children with reading problems which shows no intellectual deficit. It is said that severe reading disability may be determined by measures other than intelligence (Johnson 1955). These measures include visuo-motor competence (Koppitz 1964), language tasks such as word meaning tests and storytelling tests (Weiner and Feldmann 1963), and combinations of tests, the earliest being Mon-roe's Reading Aptitude Test (1935). Katrina de Hirsch, et al. (1966) found that tests of fine motor coordination

(pencil use), visuo-motor ability, auditory discrimination, and various language measures such as categorization, number of words used in a story, word matching, and word recognition proved to be valid predictors of reading ability when used as a battery. Auditory discrimination was shown to be related to reading disability by several authors (Dykstra 1966; Bond 1935; Goetzinger, et al. 1960; Wepman 1960). As a predictor of reading disability, however, auditory discrimination has not proven to be very useful (Gates and Bond 1936; Gates 1939).

Orton (1937, pp. 72-73) describes multiple causes for delay in learning to read. For example, marked defects in vision, hearing, auditory discrimination, intelligence and emotional disturbances may all contribute to this lag. When all of these factors are excluded, however, Orton contends that "there remains a group of very considerable size who . . . are confronted with reading . . . and cannot accomplish (it)."

Thus, many factors have been considered relative to reading disability. The relation between speech and reading also has been considered. This appears to be reasonable since both speech and reading deal with the language modality of communication. Due to the similarity of these two processes, the present project seeks to determine whether specific speech functions may be predictive of reading disability.

Review of the Literature

Consideration of speech and reading as similar acts is not a new concept. Bordie (1970) and several other authors as far back as Orton (1937) have shown that reading and speaking have a close relationship. Jones (1951) showed five similarities. First, he proposed that both reading and speech may be looked upon as "overlaid functions;" that is, they both use systems biologically developed at earlier evolutionary times for other functions, i.e. seeing and eating. His next point suggested that a state of "readiness" is presupposed for each. Thirdly, according to Jones, personality, emotional and environmental disturbances may affect both reading and speaking. He further noted that constitutional and physical factors may deter speaking as well as reading. The final and perhaps most important similarity outlined by Jones was that both speaking and reading require association of meaning with a symbol. Betts (1946) agreed with this similarity as he described speech and reading as two facets of language. He further stated that speech patterns may either contribute to the development of reading ability or impede it. Alice Yardley (1962) said that as reading develops, " . . . it enables the decoder to read units and phrases rather than individual words" after the task of combining individual units (letters) into words has been mastered.

Most studies which have dealt with the relationship between speech and reading have agreed that poor speech is related to poor reading ability. These studies, however, have been lacking in specific descriptions of the types of speech disorders such children exhibit. Many authors have said that poor reading is related to "speech defects" without elaborating further (Anderson and Kelly 1931; Bennett 1938; Johnson and House 1937). Some have shown a correlation between poor articulatory ability and poor reading (Weaver, et al. 1960; Artley 1948; Yednack 1949; Kelly 1966). Conversely, Sommers et al. (1961) have shown that speech improvement programs with children normal in articulation as well as children with misarticulations produced significantly higher reading factor scores. Once again, the types of articulation errors were not described. Hildreth (1946) suggested that the relationship between speech and reading may be due to inadequate or improper motor coordination in articulation characterized by "indistinct and inaccurate articulation" displayed by the poor readers. What Hildreth described as "muffled and indistinct articulation" may have involved errors in appropriate syllable sequencing.

Broadbent (1958) believes that man's ability to sequence enables him to use language. He states that "speech is the most obvious case of stimuli being dealt with in sequences" (1958, p. 47). The importance of this language

concept along with the structure of language in the emergence of reading is stressed by Feldmann (1969).

The child must be able to recognize individual letters and their ordering in space, must discriminate sounds and note their temporal sequencing, must recall both visual and auditory patterns, must integrate these two and perceive the sound-symbol correspondence.

Early studies of the ability to put verbal sounds together revolved around diadochokinetic rate (Lundeen 1950; Albright 1948). These dealt with the rapidity with which a child could articulate various sounds in combination. Fletcher (1968) stressed that in order for any test of diadochokinesis to have clinical relevancy to speech physiology, it must "subsume the particular physiological act in question." Therefore, such tests must include speech elements. Blakeley (1973, p. 52) carries this logic further when he states that he is "more interested in determining whether children can actually make oral movement sequences" rather than the speed with which they make the movements. Fay (1966, p. 43) warns against describing sequencing errors as a "mere articulatory disability," since the phonemes per se do not suffer from faulty production, but rather are rearranged in time. Miller, quoted in Fay (1966, p. 18), describes the sequential process when he states:

There are few clues in the physical process to indicate how this continuous stream of sound is to be sequenced, yet every speaker and listener deals with the stream as though it consisted of isolated elements put together like beads on a

string.

Efron (1963) describes the necessity of sequencing in a general manner. In order to deal appropriately with the events in one's environment, he states, he must be able to determine when the event occurred in relation to other events. With regard to speech, this would indicate that the speaker and listener must not only identify sounds, but also must identify sound patterns, or sequences.

de Hirsch (1955) relates the need to sequence in spoken sounds to a similar need in the development of reading skills. "A sequence of letters seen, a sequence in space, has to be translated back into a sequence of sounds heard, a sequence in time." She further notes that most children who develop reading difficulty seem to have trouble with patterning the units of words and sentences into spoken speech. Lashley (1954, p. 115) describes temporal and spacial order as interchangeable processes when he analyzes the reading process in the same manner as de Hirsch. Several authors have related sequencing errors directly to reading problems. Lecours and Twitchell (1966) indicated that poor readers make sequential errors in written language while Doehring and Rabinovich (1969) showed a possible relationship of auditory sequential process disorders with reading disabilities. The relationship of verbal sequencing in relation to reading has been described by Isom (1968) and Blakeley (1973). Both authors

state that children with reading disabilities often have difficulty with motorically complex verbal sequences. Isom (1968) additionally states that in reading disabled children, the more unfamiliar the material, the more difficult the verbal sequencing task becomes.

The learning disabled child has been described as one who has normal intelligence, yet shows a significant deficit in one or more areas of learning, specifically reading, spelling, or arithmetic ("Learning Disabilities" 1972). A child with learning problems also may show problems in general academic achievement. The process of sequencing is important in the learning disabled child. Kallan (1972) believes that "the learning disabled child is . . . handicapped in solving his learning problems because of temporal disorientations . . . and arrhythmical sequencing." She hypothesizes that rhythm and motoric sequencing may be the cohesive qualities which build the bridge between the various perceptual modalities. Massaro (1972) describes the sequential process as a form of feedback loop or servomechanism. During the time, or "temporal course of the perceptual processing," the auditory image is vulnerable. If another unit is introduced, it may interfere with the perceptual unit of the first. That is, until one unit has been perceived, the "perceptual circuit" should be free of interfering information. This view is supported by Aten and Davis (1968) as they describe

"sequential thresholds." They believe that hyperactivities and other bizarre behaviors sometimes associated with learning disabilities may be attributable to frustration which develops as sequential thresholds, both perceptual and oral, are approached or exceeded. In other words, the integration of the normal number of input channels may be too great for these children. Fletcher (1972) describes the speech organs as a mechanical system. The articulators act as weights, levers, and energy sources. Thus, they may be presumed to follow the laws of mechanics. The mechanical limit that could be imposed on this system could be limited by:

. . . the inertia of the system, and by the time needed in the central nervous system to code the motor movements and motor sequences, to transmit impulses to the motor end plates of the muscles generating the spoken signals and, possibly, to scan and modify the ongoing output for accuracy.

Although Fletcher feels that rate of articulation is the "overload" to the system, it appears logical that almost any of the processes could impose such a limit to the system.

The motor theory of speech (Liberman, et al. 1967) proposes that, during speech recognition, we do not directly associate the sound qualities we perceive with linguistic units, the phonemes, words, etc., but that we first interpret our auditory percepts in terms of the articulatory movements needed to produce these sounds. In a second stage, we recognize the language units by

association with these articulatory movements. A corollary of this theory is that an essential part of the process of learning to recognize speech is training in producing speech itself. Utilizing this motor theory of speech, Locke (1970) defines subvocal speech as the articulatory aspects of language and related behaviors which are covert, but measurable. Nesbitt (1971) describes subvocal speech as "mostly covert, unphonated measurable muscular movements in the oral, pharyngeal, and laryngeal areas." Edfeldt (1960, p. 83) hypothesized that subvocal speech is used in learning to read "because the words must be pronounced in order for the reader to understand what he reads." This means that the support given to reading by speech is, to begin with, very great. At this point, perception may be more closely related to articulation than to the acoustic (or visual) cues (Liberman, et al. 1967). Although some authors (Hardyck and Petrinovich 1969) state that subvocal speech impedes the speed of reading, Edfeldt (1960, p. 83) explains that as the pupil reads with greater assurance, he has less and less need for the "detour through silent speech" in order to understand the content of the text. Conrad (1972) says, "At present we have to accept that silent speech in reading is a near universal in cultures where alphabets are used." Although he concludes that short term memory is more important to reading than silent speech, he believes that the speech

code best sustains the necessary short term memory process. Conrad concludes, "In the end, then, our view is that reading is most certainly possible with no phonology involved at all, but that with phonology it is a great deal easier."

Savin (1972) has found that in his experience, "Everyone who has failed to learn to read even the simplest prose by the end of the first grade has been unable to analyze syllables into phonemes." That is, children first hear words as units and later break the words into individual sounds. To master reading, this step must evolve. Thus, if a child has difficulty with verbal sequencing, or putting the sounds together, he also may exhibit problems in subvocal sequencing and consequently the sequencing required to master the task of learning to read.

With the initial relationship between reading and speech and the later correlation between motoric sequencing, learning disabilities, and reading specifically, it seems apparent that ability with a speech task containing components similar to those required for the development of reading might prove to be a predictor of reading ability. The child must relate letter-word symbols to the verbal symbols and concepts for which they stand (Masland and Cratty 1972). Both speech and reading involve organization of a group of symbols, heard, written and most probably subvocally produced, into meaningful units. Since

the cross-modal perceptual processes involve sequencing abilities (Kallan 1972), verbal sequencing may yield information regarding the learning process. Due to the sequencing needs in speech and reading, this author will attempt to show a relationship between verbal sequencing ability and reading ability. Secondly, an attempt will be made to correlate verbal sequencing with general academic achievement, due to the relationship between various sequencing tasks and learning or general academic achievement. The advantages of such relationships would lie in the early identification of children with reading and/or learning disorders. According to Shiffman, quoted in Lawson (1970), if learning disabled children are recognized before the second grade 82 percent could be brought up to grade level. If unrecognized until the third grade, only 46 percent would reach grade level. If delayed until the seventh grade, only 10-15 percent could be successfully treated. A verbal sequencing test could be easily and quickly administered by a qualified person familiar with the test as part of a "readiness" test battery. This test is short, requires little interpretation, has norms, and is predictable. Many "readiness" tests being used now lack one or more of these qualities. The verbal sequencing test might prove to be valuable in placement of children and in the planning of educational strategies. The early identification of children with potential reading or

learning problems would enable educators to set up remedial and/or preventive programs before the pattern of unsuccessful attempts and improper training becomes irreversible.

Purpose of the Study

The primary purpose of this study is to determine if verbal sequencing ability is a valid predictor of reading ability for a group of preschool children. Secondly, the investigation will determine whether such verbal sequencing ability is predictive of general academic ability.

Specifically, a group of children tested eight years ago by Blakeley will be located and examined for reading ability and school achievement to determine the predictive value of sequencing ability. Additionally, interexaminer reliability of the Blakeley Verbal Sequencing Ability Tests will be determined.

CHAPTER II

METHODS AND PROCEDURES

Administrative arrangements for entering the Portland Public Schools for testing were carried out through Mrs. Ruth Peets, Specialist in Speech and Hearing. Once the subjects were located and met the screening criteria, the tests were administered. Further information on each of the subjects was obtained from their school records. Indications of general academic achievement were shown by two standardized tests, the Portland Achievement Test, and the Metropolitan Achievement Test. When the results from either of these two measures were not available, the School Ability Test was used as the index of academic achievement. Records indicating whether or not a subject had received any remedial assistance in speech or reading also were located in the subject's permanent records.

Elimination of any clinical bias was accomplished by testing the subjects before the school records were studied. This procedure assured that the author would be unaware of each subject's academic record.

Location and Identification of Subjects

The children used in this study were those children originally tested by Blakeley, in his normative study for

the Blakeley Verbal Sequencing Ability Tests. Those currently studied were selected from the 100 children who were five years to five and one-half years of age at the time of Blakeley's original testing. The names of the subjects, as well as the schools they attended during the original testing, were obtained from the Blakeley data for verbal sequencing ability.

Thirty five children from the original 100 studied were located through the efforts of Mrs. Peets, Portland Public Schools. The principal of each subject's school was contacted to discuss the study, review an abstract of the study (see Appendix A), and arrange for testing the children. When parental permission letters (see Appendix B) were received, testing proceeded.

Subjects

Thirty one subjects from Blakeley's original sequencing normative group were used in this study. Only 31 of the children located were permitted by their parents to participate in the study. All subjects were Caucasian and originally selected from four "middle class" schools, as defined by the school administration staff (Blakeley 1973, p. 53). At the time of the present study, subjects were 13 years of age. Thirteen of the subjects were male and 18 were female.

Screening

The subjects used in the study were those still located within the Portland Public Schools. Additionally, subjects showed no neuromuscular handicaps or speech defects originating since Blakeley's study which might interfere with imitation of the test units presented. That is, they were able to articulate /pΛ/, /tΛ/, and /kΛ/.

Testing

The Gilmore Oral Reading Test (see Appendix C) and the Blakeley Verbal Sequencing Ability Tests (see Appendix D) were administered to all 31 subjects. The reading test was administered first to insure objectivity in scoring. Following the reading test, ability in verbal sequencing was checked. All tests were administered and scored by the present investigator.

Scoring of Tests

Errors in oral reading were recorded as the child read the test material. Comprehension questions were marked correct or incorrect as the child gave his answer. Total amount of errors and correct responses to comprehension questions were tabulated after each testing session. Raw scores of reading accuracy and reading comprehension were converted to stanine scores, as indicated in the test

manual.

The results of the verbal sequencing ability tests were recorded as the child performed each task. After testing, totals were figured. The scores indicated how many nonsense syllables, words, and sentences the child replicated.

Setting

Subjects were tested individually in a single session. As each child arrived at the test room, the author talked with each briefly about school, his interests, and the nature of the study. Once rapport had been gained, instructions for the reading test were given and testing proceeded. Testing took place in a quiet room provided by the school. No apparent distractions were evident and no disturbances or interruptions occurred during the testing sessions.

School Information

The cumulative folder for each child was obtained from the school secretary. Results of the Metropolitan Achievement Test and the Portland Achievement Test, administered in 1972, were recorded for each subject from their Educational Profile Card. The School Ability Test scores were recorded for children who had neither of the two achievement test scores, due to absenteeism during the

testing. These were administered at various times from 1968 through 1971. Results were recorded in standard scores.

Indications of previous or current remedial reading and/or speech therapy were obtained and recorded. These data were obtained from the cumulative folders.

Reliability

Reliability data for the Gilmore Oral Reading Test can be found in the test manual. Interexaminer reliability of the Blakeley Verbal Sequencing Ability Tests was checked as part of the present study. To accomplish this, Blakeley administered his test to ten children tested by this investigator. Five subjects were male and five were female. His test was administered approximately one month after this investigator tested the subjects to avoid any practice effect.

Data Analysis

The original sequencing scores on the three-syllable, nonsense, sequence task repeated three times were analyzed with respect to current reading accuracy ability, current reading comprehension ability, and school achievement. This correlation was figured for male subjects, female subjects, and a total subject group. To quantify this procedure, least squares linear regression equations were

tabulated using a Monroe desk calculator, model 1785. These tabulations resulted in a correlation coefficient, the slope of the regression line, and the point where the line intersects the Y axis when graphed. The amount of variability of the reading scores and school achievement which can be accounted for, if the original sequencing scores are known, was determined by squaring the correlation coefficient.

Current sequencing ability was viewed in relation to original sequencing ability and current reading ability. Variance in each of these categories was determined by viewing the results.

Interexaminer reliability analysis of the Blakeley Verbal Sequencing Ability Tests was accomplished by comparing this investigator's scores with those of Blakeley. The 20 scorable items on the test were included in the comparison.

CHAPTER III

RESULTS AND DISCUSSION

Results

Scores on the original syllable sequencing test of the sentence "Persistence is essential to success" indicated that none of the subjects were able to repeat it. The variance of responses on the three motorically complex words "aluminum," "linoleum," and "statistics" was not statistically significant to qualify as a discriminating factor. Therefore, the score on the triple-syllable nonsense sequence repeated three times was used. This measure showed enough intersubject variability to serve as a discriminating predictor of reading accuracy, reading comprehension, and school achievement. Thus, the triple-syllable nonsense sequence is referred to as the "original sequencing score" throughout the study.

Total Group

Overall results for the total group of 31 subjects are seen in Table I. As indicated above, Column I was not used for analysis due to lack of variance in the scores. Column II is the "original sequencing score." Statistical analysis of results is seen in Table II.

Using the least squares equation for linear

TABLE I
COMPOSITE OF INDIVIDUAL SCORES

	I	II	III	IV	V	VI	VII	VIII	IX
M A L E S	No	0	2	3	41	Yes	No	Yes	No
	No	1	2	2	40	Yes	No	No	Yes
	No	3	4	5	39	Yes	No	No	No
	No	3	3	3	42	Yes	Yes	Yes	Yes
	No	3	5	7	52	Yes	Yes	No	No
	No	3	7	8	57	Yes	Yes	No	Yes
	No	4	4	7	53	Yes	Yes	Yes	No
	No	5	5	4	44	Yes	Yes	No	No
	No	5	4	5	46	Yes	Yes	No	No
	No	5	4	6	53	Yes	Yes	No	No
	Yes	5	3	7	54	Yes	Yes	No	Yes
	No	5	7	8	66	Yes	Yes	No	No
	Yes	5	6	9	70	Yes	Yes	No	No
F E M A L E S	No	1	6	6	52	Yes	Yes	No	Yes
	No	3	1	2	42	No	No	No	No
	No	3	5	2	48	Yes	Yes	Yes	No
	No	3	5	9	50	Yes	Yes	No	No
	No	4	1	1	46	Yes	Yes	No	No
	No	4	7	5	54	Yes	Yes	No	No
	No	4	5	6	59	No	Yes	No	No
	No	4	5	5	61	Yes	Yes	No	No
	No	5	4	4	45	Yes	Yes	No	No
	No	5	5	5	46	Yes	Yes	No	No
	Yes	5	3	5	47	Yes	Yes	No	No
	No	5	8	4	48	Yes	Yes	No	No
	No	5	7	4	49	Yes	Yes	No	Yes
	Yes	5	8	6	52	Yes	Yes	No	No
	No	5	5	2	54	Yes	Yes	No	No
	No	5	7	6	57	Yes	Yes	No	No
	No	5	9	8	60	Yes	Yes	No	No
	Yes	5	9	7	67	Yes	Yes	No	No

Column Key:

- I Original sequencing score of three words.
- II Original sequencing score of five three syllable nonsense sequences.
- III Current reading accuracy stanine score.
- IV Current reading comprehension stanine score.
- V Current academic achievement standard score.
- VI Current sequencing score of three words.
- VII Current sequencing score of sentence.
- VIII Received remedial reading.
- IX Received speech therapy.

TABLE II
COMPOSITE OF STATISTICAL DATA

	I	II	III
<u>Total Group</u>			
Correlation coefficient	.416	.257	.422
Slope	.650	.407	2.447
Y intercept	2.453	3.578	41.709
<u>Male Group</u>			
Correlation coefficient	.533	.600	.571
Slope	.530	.800	3.377
Y intercept	2.391	2.800	38.330
<u>Female Group</u>			
Correlation coefficient	.309	.016	.166
Slope	.653	.032	.984
Y intercept	2.800	4.700	47.900

Column Key:

- I Verbal sequencing compared to reading accuracy.
- II Verbal sequencing compared to reading comprehension.
- III Verbal sequencing compared to academic achievement.

regression the following results were obtained when determining the predictive value of original sequencing score for reading accuracy. By squaring the correlation coefficient of .416 it was indicated that if the original sequencing score is known, one can account for 17.3 percent of the variability in reading accuracy scores. The slope of the linear regression was .650, with the Y intercept being 2.453. The slope and location of the linear regression are found in Figure 1.

Computing the predictive value of original sequencing for reading comprehension ability involved the same procedure described above. The correlation coefficient was .257. Thus, if original sequencing ability is known, only 6.6 percent of the variance in reading comprehension scores can be estimated. The slope of the linear regression was .407, with a Y intercept of 3.578. This is seen in Figure 2.

Analysis of academic achievement as predicted by original sequencing score yielded these results. The correlation coefficient was .422 indicating that variance in school achievement is accounted for in 17.8 percent of the cases when viewing original sequencing as the predictor. The slope of the regression line was 2.447. The line intersected the Y axis at 41.709 (see Figure 3).

Figure 1. Linear regression of original sequencing score compared to reading accuracy score for total group.

Figure 2. Linear regression of original sequencing score compared to reading comprehension score for total group.

Figure 3. Linear regression of original sequencing score compared to academic achievement for total group.

Males

Results of the scores of the 13 males used in this study were computed separately to yield additional information. Using the least squares equation, a correlation coefficient of .533 was found for original sequencing as a predictor of reading accuracy. By squaring this coefficient, it was shown that original sequencing score accounts for 28.4 percent of the variability of reading accuracy scores. The slope of the linear regression line was .530, with a Y intercept of 2.391 (see Figure 4).

Original sequencing score as a predictor of reading comprehension in males was determined. The correlation coefficient was .600, showing that 36 percent of the variance in comprehension scores was accounted for by original sequencing scores. The linear regression slope of .800 and Y intercept of 2.800 are illustrated by Figure 5.

School achievement as predicted by original sequencing score yielded a correlation coefficient of .571. Thus, 32.6 percent of the variance in school achievement is attributed to original sequencing scores. The slope of 3.377 and Y intercept of 38.330 are shown in Figure 6.

Females

The scores of the 18 females tested revealed the following data. The comparison of original sequencing

Figure 4. Linear regression of original sequencing score compared to reading accuracy for male group.

Figure 5. Linear regression of original sequencing score compared to reading comprehension for male group.

Figure 6. Linear regression of original sequencing score compared to academic achievement for male group.

score with reading accuracy showed a correlation coefficient of .309. Original sequencing score accounts for only 9.5 percent of the variability in reading accuracy. The slope of .653 and Y intercept of 2.800 are illustrated in Figure 7.

The correlation coefficient for original sequencing as compared with reading comprehension was .016, indicating that original sequencing ability is not responsible for any variance in reading comprehension scores. The linear regression line (Figure 8) showed a slope of .032 and a Y intercept of 4.700.

Figure 9 graphs the linear regression line of the relationship between original sequencing score and school achievement. A correlation coefficient of .166 indicated that only 2.8 percent of the variance in school achievement could be attributed to original sequencing scores. A slope of .984 was found in addition to the 47.900 point of Y intercept.

Current Sequencing Ability

All 31 subjects used in this study were able to repeat the five, three-syllable, nonsense sequences. There was not enough variability in sequencing ability on the words or the sentence to warrant further calculations. For this reason, current sequencing scores were excluded from the study.

Figure 7. Linear regression of original sequencing score compared to reading accuracy score for female group.

Figure 8. Linear regression of original sequencing score compared to reading comprehension score for female group.

Figure 9. Linear regression of original sequencing score compared to academic achievement for female group.

Indication of Remedial Reading and Speech Therapy

The number of subjects receiving remedial reading and/or speech therapy was so slight that sufficient variance was not found to necessitate tabulation of scores. Thus, it can be said that original sequencing score was not predictive of reading or speech therapy for this group of children.

Reliability of the Blakeley Verbal Sequencing Ability Tests

Results of testing done by this experimenter and Blakeley using the Blakeley Verbal Sequencing Ability Tests are shown on Table III. The tests were administered to the same 10 subjects from one school, five male and five female, by both testers a month apart. Of the 20 test items, all scores were identical except for two. Due to the noted high interexaminer reliability using the same subjects over a period of one month, no tabulations were run. Thus, interexaminer reliability of the Blakeley Verbal Sequencing Ability Tests was found to be extremely high.

Discussion

Results of the total group of 31 subjects suggested that verbal syllable sequencing was only slightly predictive of reading accuracy. The correlation coefficient of .416 indicates that only 17.3 percent of the variability in reading accuracy scores could be related to the

TABLE III

RELIABILITY OF SEQUENCING TEST

		Double syllable/ Single sequence 0-3		Double syllable/ Triple sequence 0-3	
		Test	Retest	Test	Retest
Male		3	3	3	3
		3	3	3	3
		3	3	3	3
		3	3	3	3
		3	3	3	3
Female		3	3	3	3
		3	3	3	3
		3	3	3	3
		3	3	3	3
		3	3	3	3
		Triple syllable/ Single sequence 0-5		Triple syllable/ Triple sequence 0-5	
		Test	Retest	Test	Retest
Male		5	5	5	5
		5	5	5	5
		5	5	5	5
		5	5	5	5
		5	5	5	5
Female		5	5	5	5
		5	5	5	5
		5	5	5	5
		5	5	5	5
		5	5	5	5
		Words Yes/No		Sentence Yes/No	
		Test	Retest	Test	Retest
Male		Yes	Yes	Yes	Yes
		Yes	No	No	No
		Yes	Yes	Yes	Yes
		Yes	Yes	Yes	Yes
		Yes	Yes	No	No
Female		Yes	Yes	Yes	Yes
		Yes	Yes	Yes	Yes
		Yes	Yes	Yes	No
		Yes	Yes	Yes	Yes
		Yes	Yes	Yes	Yes

sequencing score. The predictability of reading comprehension was much less encouraging. Only 6.6 percent of the variability in reading comprehension scores could be attributed to syllable sequencing ability. Otto, McMenemy, and Smith (1973, p. 121) warn that reading comprehension testing is often invalid when preceded by an oral reading task. This may account for this low correlation, but this author feels other factors are involved. These factors are explored further in discussion of male versus female scores. A slight relationship between original sequencing score and academic achievement was noted, since original sequencing score accounted for 17.8 percent of the variability of scores on achievement tests. This indicates a trend of relationship, but not as high as was predicted.

The most interesting outcome of this study is revealed in a comparison of the male scores and the female scores. The correlation coefficients and the consequent percent of accountable variability were consistently higher for the males in all three categories, reading accuracy, reading comprehension, and academic achievement. Original sequencing score was responsible for 28.4 percent of the variance in reading accuracy scores for the male group. The female group scores, however, suggested that only nine percent of the variance was due to original sequencing score. The same trend is seen when comparing original sequencing score with reading comprehension scores.

The males' scores indicated 36 percent traceable variance in comprehension, while female scores showed no significant relationship. School achievement scores were shown to be predictable from original sequencing score by 32.6 percent in males and only 2.8 percent in females. The sex difference in predictability was also found in the research of de Hirsch, et al. (1966, pp. 32-33). They noted that one test battery was predictive for white females and black males and females, but not for white males.

This rather wide discrepancy between the groups indicates to this author that syllable sequencing scores are more predictive for five year to five and one-half year old males than for females of the same age in the group of children studied. The reason for this discrepancy between the two groups may be neurologically based. Aten and Davis (1968) indicate that deficiency in oral sequential accuracy may be due to a neurological impairment. The relationship between speech and reading, according to Hildreth (1946), may be due to inadequate or improper motor coordination. Viewing these two ideas together, the verbal sequencing ability of children is deeply related to neurological and motor development. Since females mature physically at an earlier age than males, perhaps the Verbal Sequencing Ability Tests were not predictive enough for five year old females. That is, instead of comparing males and females the present study was comparing different

"age" groups due to the higher rate of neurological and motor development of females. Jones (1951) suggests that reading and speech both require a state of readiness. Again, perhaps females are ready for the task by the age of five, due to maturation, while males are not. Blakeley's original data (1973, p. 199) indicates, however, that there was no statistically significant difference between the sequencing ability of males and females at this age level. This indicates the need for a larger population of preschool age children to test for the predictive value of the Verbal Sequencing Ability Tests for reading ability.

The trend of the relationship between verbal sequencing ability and reading accuracy, reading comprehension, and school achievement in males is positive. Yet, it was not as high as one might predict. Artley (1948) warns that regardless of the causal factor being studied in relation to reading, it must be considered in relation to many other factors which may render it impotent. This would indicate that de Hirsch's battery of tasks (1966) encompasses more avenues leading to reading than the single task of verbal motoric sequencing. The positive trends of verbal sequencing ability in males for predicting reading and school achievement suggest that this task should be included in a battery of readiness tasks.

Another factor which may have affected the results of this study lies in the scoring of the Verbal Sequencing

Ability Tests and the Gilmore Oral Reading Test. The non-sense portion of the sequencing test had six possible scores, zero through five. The scoring was done in this manner, since that was the format used on the original normative study using this test. The raw scores of the oral reading test are converted into stanines rather than standard scores. An expansion of possible scores on both tests might reveal a more conclusive relationship between the two measures.

This author hoped to study the relationship of current sequencing ability to current reading ability. This data would have revealed whether there was a concurrent correlation between these two tasks. Unfortunately, there was not sufficient variability in the scores of these 13 year old children to do such a study. Blakeley (1973) and Isom (1968) have stated that children with reading disabilities often have difficulty with motorically complex sequencing. The 13 year olds tended to accomplish all sequencing tasks, yet there were poor readers in the group. This may be due to the ceiling age of 12 for the sequencing test when the original study was done. In order to study simultaneous relationship between sequencing and reading ability, one would have to either use younger children or add another more difficult subtest to the sequencing test for the older subjects.

It can be concluded that verbal syllable sequencing

ability using five, three-syllable, nonsense sequences at the five year old level was not significantly predictive of reading accuracy, reading comprehension, or academic achievement for the total group of 31 children studied. The most significant finding was a result of comparing male and female scores and their relationships. The original sequencing score was much more predictive for reading accuracy, reading comprehension, and academic achievement for males than for females. The correlation coefficients of .53, .60, and .57 for the males were significantly higher than for the females, .31, .02, and .17. This difference may be due to the advanced neurological and motor development of five year old females. The limited number of subjects studied, due to the problems of locating the original subjects, also may have contributed to this discrepancy.

CHAPTER IV

SUMMARY AND IMPLICATIONS

Summary

Early identification of children with reading and learning problems seems imperative. By using early identification predictors, a high risk group of children with possible reading problems could be located. This would facilitate placement and appropriate educational strategies for this group of children. By proper placement and planning, educators then would be able to set up remedial and/or preventive programs for these children before the pattern of unsuccessful attempts and improper training becomes irreversible.

This study was designed to determine if verbal sequencing ability was a valid predictor of reading ability for a group of 31 preschool children. Secondly, the investigation attempted to determine whether such verbal sequencing ability was predictive of general academic ability for this group of children. Reliability of the Blakeley Verbal Sequencing Ability Tests was determined.

Thirty one children who were originally tested for verbal sequencing ability in 1965 when they were five years old were located in the Portland Public Schools. The

children, now 13 years old, were administered the Blakeley Verbal Sequencing Ability Tests and the Gilmore Oral Reading Test. Records of school achievement were obtained from each child's cumulative school file.

A least squares linear regression equation was used to analyze the data obtained. When the predictive value of the original verbal sequencing score was studied in relation to reading accuracy, reading comprehension, and general academic achievement, results for the total group of 31 preschool children were not promising. Verbal sequencing ability in preschool children, in general, was not significantly predictive of reading accuracy, reading comprehension, and school achievement eight years later.

Examination of the results obtained on the Blakeley Verbal Sequencing Ability Tests by Blakeley and this investigator suggested that interexaminer reliability is extremely high.

The most significant finding of this study was found through a comparison of the results of the male and female groups. The original sequencing score was a much better predictor of reading ability and school achievement for the males. The correlations were higher in all three areas: comparing original sequencing ability with reading accuracy, reading comprehension, and school achievement. This trend may indicate that the sequencing test was not discriminative enough for five year old females, due to

the advanced rate of physical and neurological development at that age. More significantly, the children used in this follow-up study may not have been representative of the original group tested, due to problems in locating the original subjects.

Implications for Future Research

The findings of this study indicate that verbal sequencing ability is not significantly predictive of reading ability and school achievement over an eight year period of time. The findings of the male group, however, show a strong relationship. This indicates the need for a more molecular analysis of the processes involved in this study.

An examination of the errors in oral reading accuracy may reveal more conclusive trends. Since there are eight categories of errors scorable on the Gilmore Oral Reading Test, this molecular analysis may yield more positive correlations between verbal sequencing ability and specific types of reading errors.

The Blakeley Verbal Sequencing Ability Tests should be expanded in all three subtests. That is, there should be more nonsense sequences, more words, and more sentences. By redesigning the test, it would offer a more discriminative score. A base level of five successful responses and a ceiling level of five failures would keep the test short,

since this is an important asset of the test. With this new tool, the same procedures used in this study may yield more positive total group correlations.

Since Artley (1948) suggests that auditory memory span is deficient in reading disabled children, an important study would compare verbal sequencing with auditory memory span. By design, the Blakeley sequencing test incorporated auditory memory span. Utilizing other perceptual and expressive modalities, one could present a group of children with a digit span task and have them write the numbers and then repeat the task using nonsense syllables. A comparison of the results would offer valuable information about what is happening in these perceptual parameters.

The same type of comparison mentioned above would further locate the sequential process. By use of the Lindamood Auditory Conceptualization Test, one could compare the non-verbal responses elicited with verbal sequencing ability.

Of the 100 possible subjects for this study only 31 were located in the Portland Public Schools who agreed to participate. Although the Portland Public Schools do not usually record new locations of students after they have left the school system, a check of their former records might help to locate some subjects in neighboring counties and states. If more of the original subjects could be

found, examination of their abilities may add new information to the findings of this study.

This author suggests that a time lapse of two or three years between original sequencing testing and reading testing may give more substantial results. Certainly the mobility rate of children would be less than over an eight year period. Additionally, if the Blakeley Verbal Sequencing Ability Tests are to be used as predictors in preschool children, a larger number of children should be tested for the first phase of such a study.

By using a new population of children, a future investigator could attempt to control several intervening variables involved with reading ability. These may include such areas as intelligence, type of home environment, mobility of the family, and academic environment. By controlling these factors, one could gain an equal sex population and test the findings of de Hirsch, et al. (1966, pp. 32-33) to determine if the difference in performance of males and females is consistent.

To determine concurrent occurrence of verbal sequencing problems with reading disability, as well as its predictive value, one could locate a group of poor readers and determine sequencing ability over a two or three year period. A control group of good readers could be used as a comparison group. This information would add additional data to the findings of this study.

To obtain generalization of results to a larger population, this investigator suggests selecting subjects from various ethnic groups and socio-economic levels. Since reading difficulty is often due to environmental factors (Otto, McMenemy, and Smith, 1973, p. 24) a predictor of reading ability should be tested in children from various environmental backgrounds. Only when this goal is achieved can any test, or battery of tests, be predictive of reading disability.

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APPENDICES

APPENDIX A

ABSTRACT TO SCHOOL PRINCIPALS

In 1965, Dr. Robert Blakeley, of the University of Oregon Medical School, Crippled Childrens' Division, developed normative data on the verbal sequencing ability of children five through twelve years of age. The 800 children used in his study were found in four schools within the Portland Public School System. This study will be published in Dr. Blakeley's book, The Practice of Speech Pathology: A Clinical Diary, currently in press. Since that time, Dr. Blakeley has suggested that a child's verbal sequencing ability may be predictive of his reading ability. He has observed this relationship clinically in several cases.

My proposed Master's thesis topic is Verbal Sequencing Ability as a Predictor of Reading Disability. Essentially, it will add a logitudinal aspect to Blakeley's study. I plan to locate as many children as possible from the 100 used in the lowest age group in Blakeley's original study. Once this is accomplished, I will readminister Blakeley's sequencing test and test each child's reading ability. The test scores and information from each child's records will be studied to determine the relationship between verbal sequencing ability, reading ability, and general academic achievement.

The testing of each child will take approximately thirty minutes. I will be administering the Blakeley Verbal Sequencing Ability Tests and the Gilmore Oral Reading Test. Following the tests, I would like permission to study each subject's school record. With the results of the tests, general academic information, and indications of any remedial aid, I will be able to determine if, in fact, verbal sequencing ability is predictive of reading ability or general academic achievement.

Paul E. Quin
Speech and Hearing Sciences
Portland State University

APPENDIX B

PARENTAL PERMISSION LETTER

February 20, 1973

Dear Parents:

Eight years ago, your child was used in a study by Robert Blakeley, Ph. D., University of Oregon Medical School. Dr. Blakeley was interested in how children at different age levels put sounds together.

For my Master's thesis, I plan to do follow-up evaluations with many of the children from Dr. Blakeley's study. I hope to develop a relationship between speech and reading. If I am correct, a short test may be given to preschool children to predict their reading ability.

I would be most appreciative if you would give me your permission to test your child and evaluate information in his school record. All results will be strictly confidential. The testing will take approximately thirty minutes for each child. To avoid interfering with academic work, all testing will be done at the student's convenience.

To indicate your cooperation in this study, please return the bottom portion of this letter to the school secretary no later than February 28, 1973.

Sincerely,

Principal

School

Paul E. Quin
Graduate Teaching Assistant
Speech and Hearing Sciences
Portland State University

I give permission for Mr. Paul E. Quin to test my child,
_____, and evaluate his school record.
I understand that all information will be strictly confidential.

Signature

APPENDIX C

SAMPLE PARAGRAPH FROM THE GILMORE ORAL READING TEST

Mother and Father have always encouraged their children to be adept in some form of athletics. When Mary and Dick were quite small, Father instructed them in the principles of baseball. Dick participated in Little League activities while in elementary school; currently he is catcher for the junior high school baseball team. The entire family attend at least one major league game every summer, although they must undertake a long excursion to the nearest large city for this occasion. Mary and Dick also acquired swimming facility when they were quite young. Even prior to the age of two, they were taught not to fear the water. Because of Father's patience, and especially because of his constant encouragement, Mary and Dick were swimming confidently before their sixth birthdays.

TIME _____ Seconds

1. What do the parents encourage the children to do?
2. What sport did Father teach Mary and Dick when they were small?
3. How does Dick now use his early acquired skill in baseball?
4. How do we know that the whole family enjoys baseball?
5. What special quality in Father's teaching helped the children become confident swimmers?

ERROR RECORD	NUMBER
Substitutions	
Mispronunciations	
Words pronounced by examiner	
Disregard of punctuation	
Insertions	
Hesitations	
Repetitions	
Omissions	

Total Errors

APPENDIX D

VERBAL SEQUENCING ABILITY TESTS

TEST I: SYLLABLE SEQUENCING

Single						Two Syllables		Triple				
1	2	3	4	5	0	PA	TA	1	2	3	0	
1	2	3	4	5	0	TA	KA	1	2	3	0	
1	2	3	4	5	0	PA	KA	1	2	3	0	
Single						Three Syllables			Triple			
1	2	3	4	5	0	PA	TA	KA	1	2	3	0
1	2	3	4	5	0	KA	TA	PA	1	2	3	0
1	2	3	4	5	0	TA	TA	PA	1	2	3	0
1	2	3	4	5	0	PA	PA	TA	1	2	3	0
1	2	3	4	5	0	KA	KA	TA	1	2	3	0

TEST II: MOTORICALLY COMPLEX UNITS

Words				
Aluminum	1	2	3	0
Linoleum	1	2	3	0
Statistics	1	2	3	0
Sentence				
Practice:				
Persistence	1	2	3	0
Essential	1	2	3	0
Success	1	2	3	0

Persistence is essential to success. 1 2 3 0