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ABSTRACT

Ten auditory and ten visual aptitude measures were administered in the middle of first grade to a sample of 58 low readers. More than half of this low reader sample had scored more than a year below expected grade level on two or more aptitudes. Word recognition measures were administered after four months of sight word instruction and again after an additional four months of intensive phonic instruction. Correlations of aptitude and word recognition scores after sight word instruction were compared with correlations of aptitude and word recognition scores after phonic instruction. The results indicated that visual aptitudes were not more highly correlated with achievement after sight word instruction, nor were auditor aptitudes more highly correlated after phonic instruction. Blending, Auditory Closure, and WISC Coding were consistently related to achievement for both kinds of instruction. All the children learned to decode before the end of eight months of experimental instruction. (Author/WR)

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THE RELATION OF VISUAL AND AUDITORY APTITUDES TO FIRST GRADE LOW READERS' ACHIEVEMENT UNDER SIGHT-WORD AND SYSTEMATIC PHONIC INSTRUCTIONS

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The University of Minnesota Research, Development and Demonstration Center in Education of Handicapped Children has been established to concentrate on intervention strategies and materials which develop and improve language and communication skills in young handicapped children.

The long term objective of the Center is to improve the language and communication abilities of handicapped children by means of identification of linguistically and potentially linguistically handicapped children, development and evaluation of intervention strategies with young handicapped children and dissemination of findings and products of benefit to young handicapped children.

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The Relation of Visual and Auditory Aptitudes to First Grade Low Readers' Achievement Under Sight-Word and Systematic Phonic Instruction

by

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Abstract

Ten auditory and ten visual aptitude measures were administered in the middle of first grade to a sample of 58 low readers. The sample was drawn from a large population of children in a suburban school system who had been selected by their teachers for an experimental phonic emphasis project for pupils in the low reading groups. More than half of this low reader sample scored more than a year below expected grade level on two or more aptitudes.

Word recognition measures were administered in January after four months of sight word instruction and again after an additional 4 months of intensive phonic instruction. Correlations of aptitude and word recognition scores after sight word instruction were compared with correlations of aptitude and word recognition scores after phonic instruction. Contrary to hypothesis, visual aptitudes were not more highly correlated with achievement after sight word instruction nor were auditory aptitudes more highly correlated after phonic instruction. Blending, Auditory Closure and WISC Coding were consistently related to achievement from both kinds of instruction. A combination of Auditory Closure and Visual Sequential Memory scores best discriminated clinically the children who did not learn to decode after four months of experimental instruction. Equal numbers of children with similar scores learned to decode successfully. All children learned to decode before the end of eight months of experimental instruction.

The Relation of Visual and Auditory Aptitudes to First Grade Low Readers' Achievement Under Sight-Word and Systematic Phonic Instruction

One of the challenges in educating handicapped children to read and write is the task of fitting instruction to the needs and learning patterns of the child. Which characteristics are significant in determining the most efficient procedures has been a subject of much argument--particularly in the field of learning disabilities. Should some children be taught from a so-called auditory method, and if so, which ones? Should others be taught from a so-called visual method, and if so, what characteristics indicate this is the most effective strategy to follow? Fitting the reading method to the child's learning patterns, particularly his modality strength has been the most popular of the prescriptions (Bannatyne, 1970; Johnson and Myklebust, 1967; Cohn, 1967; Myers and Hammill, 1969). Under this hypothesis learners with stronger auditory learning profiles should be assigned to an auditory or phonics first method and learners with stronger visual aptitudes should be assigned to a visual or sight-word first method. An adequate test of this hypothesis would seem to require that instruction in the prescribed procedure be maintained for more than a few weeks; probably for at least a year. Few such experiments have been conducted. Those that have been attempted have not demonstrated any improvement in reading achievement in groups so assigned. (Bateman, 1969; Harris 1965). Bateman's study found significant differences in favor of the phonics-from-the-start, straight coding approach of the Lippincott series for all learners. In Bateman's experiment, low auditory learners had more difficulty than low visual learners regardless of reading method, but these low auditory children did better in the phonic method than in the sight-word first method. The group that made the poorest progress was the high visual-low auditory group that was taught by the visual approach. However, her sample was made up of high achieving high aptitude children. Many of her low auditory group had above average auditory scores even though auditory scores were lower than visual scores.

Since experimental assignment of children to different methods is difficult to accomplish in the schools, other studies have attempted to investigate the problem statistically. Among the first grade reading studies reported by Dykstra (1967), for example, none experimentally assigned children with different modality strengths to different methods but an attempt was made to assess the aptitude by treatment effects statistically by comparing the correlational pattern of auditory and visual aptitudes in each of the methods. No differences in the predictiveness of auditory vis à vis visual aptitudes were found for phonic emphasis methods compared with sight-word-first methods. Both auditory and visual perceptual skills in kindergarten were equally highly correlated with end of second grade achievement regardless of method used. Bond and Dykstra (1967) also conducted a "blocking study" analysis in which they statistically grouped low, middle, and high auditory discrimination pupils, low and high visual discrimination pupils, and low and high I.Q. pupils on the basis of their kindergarten aptitude scores. They then compared the mean achievement for each group in a basal or sight-word method with achievement under each of the various phonic or coding emphasis methods at the end of first grade. In a number of comparisons for the groups as a whole the coding emphasis approaches produced higher achievement (usually higher word recognition skills) than the sight word basal approaches. Analysis of achievement by different aptitude groups indicated that whenever the phonic emphasis programs were superior in achievement, they were equally superior for all aptitude groups. Dykstra concluded in the report on end of second grade achievement that there was no evidence in these studies to support differential assignment to method on the basis of either auditory, visual, or I.Q. characteristics.

On the other hand, several studies of short-term behavior and learning have found higher performance when the modality strength of the child was paired with methods which emphasized this modality (Bruininks, 1970; Snow, 1969).

In summary, several studies of short term learning and or behavior furnish some support for matching the instructional strategy in reading to the modality strength of the child, but results from studies of the effect of aptitude on achievement over a longer time suggest that auditory, phonic, or coding emphasis approaches produce superior achievement for both low auditory and low visual learners. Chall's (1967) conclusions favoring procedures which teach sound-symbol relations on phonetically regular words for all children may apply regardless of aptitude pattern for most children.

These results however, do not indicate what the situation may be for that small percentage of children who have learning disabilities. These children are presumed to have greater variation in aptitudes and more serious reading deficiencies. Though some of these children must have been included in the above studies, the effects of the different methods on this small minority could have been masked by the effects on the majority. One means of determining more precisely the effect of aptitudes on the achievement of learning disability children under different methods is to study the aptitude-treatment interactions among low readers since the learning disability population would represent a much higher proportion of these groups.

The present study measured auditory and visual aptitudes in the middle of first grade o: children who had been selected by their teachers as low readers at that time. It related these aptitudes to these low readers achievement in mid January after they had had several months of instruction in a sight word approach. It then related these aptitudes to the achievement of this same group of children after 4 months of intensive phonic instruction. We sought to ascertain whether children with low visual ap itudes had the most trouble during the period of sight word instru. on and children with low auditory aptitudes had the most trouble during the period of intensive phonic instruction. In other words, were visual aptitudes more highly correlated with achievement under sight word instruction (before the experimental instructional procedures were introduced) and auditory aptitudes more highly correlated with achievement after experimental phonics instruction?

We also sought to determine which aptitudes or test measures most accurately predicted the children who had trouble in each approach. We were particularly interested in determining the validity of individual predictions based on scores from these aptitude measures. That is, we tried to simulate the situation the diagnostician faces in deciding who is eligible for service in a learning disability program, when or if reading instruction should be postponed, and what kind of reading instruction should be prescribed. Many clinicians believe that children with very low auditory skills cannot be taught by methods which depend on learning the sounds for the symbols from the beginning. So we sought to determine how low a child's auditory skills needed to be before he seemed unable to learn to decode simple words when taught from synthetic-phonic procedures which emphasized kinesthetic techniques and included training in sequencing and blending.

Method

Design

Ten auditory and visual aptitude measures were administered to 64 low reading first grade children in January at the time they were selected by their teachers for the experimental reading project. Two word-recognition measures of reading achievement were administered to these children at the same time. At the time of initial testing the children had had four months of instruction in a sight-word approach. In May, after four months of instruction in a synthetic-phonic approach, the two word-recognition measures were readministered. Correlations were computed between auditory and visual aptitude measures and achievement in January after sight-word instruction and recomputed in May after phonic instruction.

Aptitude scores of the small group of low readers who did not succeed in learning the first decoding skills were compared with aptitude scores for those low readers who did succeed, and both were compared with aptitude scores from the normative sample for those tests for which this data were available. The accuracy of clinical prediction of success in learning to decode was examined by plotting and combining graphically individual scores on the most discriminating aptitudes by successful and nonsuccessful decoders at the end of the first grade.

Subjects

The subjects were first grade low readers in a middle class suburban school district. All children who were judged by their teachers in January of their first grade year to be making slow progress in learning sight words and in reading in their basal primers had been assigned to the experimental project after administration of a confirming word-recognition measure by the school psychologists. These children comprised approximately 30% of the first grade population in the district. They included all children who had the most trouble learning to read, some of whom had been passed by their teachers from kindergarten in spite of judgments of low readiness and some of whom tested in the borderline retarded range.

The original sample to whom the aptitude and achievement tests were administered consisted of 64 children randomly selected from each first grade room in 8 of the 20 elementary schools in the district. At the time of post-testing several children were lost because of incomplete data or because they moved before the Spring achievement tests were administered. The final sample consisted of 58 children (approximately 9% of the first grade children assigned to experimental instruction).

Experimental Treatment

The experimental instructional procedures are described more fully in Enfield (in preparation) and in the manuals and materials available from the school district. The sounds for individual symbols were taught directly and in isolation using kinesthetic procedures at the beginning and throughout the instruction whenever a child encountered difficulty. When the children could give the sounds for a few symbols they were then taught to sequence and blend those sounds into words and to apply these "decoding" and "encoding" skills to reading and spelling any word or nonsense syllable which incorporated those particular sounds within a particular phonic structure, (e.g., two and three letter short-vowel words ending in a single consonant). The linguistic or phonic structure of the words and the code cues which determined the sounds were taught as concepts. Spelling always accompanied "reading." Sounds and words were introduced in the approximate order used in many "linguistic" readers. Once the process of decoding words within a particular linguistic structure was mastered, the children read orally from appropriate passages in the SRA Basic Reading Series (Rasmussen and Goldberg, 1965).

Aptitude Measures

The aptitude tests administered were selected to assess visual and auditory functions previously found to be associated with reading difficulty. These functions included auditory and visual discrimination, auditory and visual figure ground analysis, auditory and visual memory, and auditory and visual synthesis, i.e., blending and closure.

The following tests of visual function were given:

Primary Mental Abilities - Perceptual Speed (PMA-PS) and Space Relations (PMA-SR). Thurstone and Thurstone, 1963. The Perceptual Speed subtest measures simple visual discrimination and visual discrimination of position in space (Thurstone and Thurstone, 1963). The Space Relations subtest measures visual discrimination of position in space and also may measure visual analysis. In part it requires the child to fill in missing parts to match a completed design.

Wechsler Intelligence Scale for Children (WISC) Coding Subtest. Although it has been variously interpreted by psychometric specialists, the Coding subtest was considered to measure short-term visual memory, and motor speed. Lowered WISC Coding, has frequently been found to discriminate between good and poor readers (e.g., Review in Barron, 1971).

Illinois Test of Psycholinguistic Abilities (ITPA). Two visual subtests of the ITPA (Kirk, McCarthy, and Kirk, 1968) were selected from the automatic level. Deficits at this level are most apt to relate to the learning to read process (Kass, 1966). Visual Closure measures the ability to identify or find pictures of simple objects quickly when only part of the object is visible. Figure-ground abilities also may be tapped since the partially completed objects must be discerned within a complex picture. Visual Sequential Memory requires the child to place chips on which are printed simple symbols in the order in which they are shown on a card which he examines briefly. It is a measure of short-term visual memory for sequences of nonmeaningful stimuli.

The following measures of aptitude in auditory processing functions were also administered:

Goldman-Fristoe-Woodcok Test of Auditory Discrimination (GFW). Both the "silent" and "noisy" subtests were given. In the "silent" condition, the child points to the one picture among four possible pictures which illustrates the word pronounced. The words are dictated from a tape which is played by the examiner. Since the child has previously been tested on knowledge of the pictured meaning of the words used in the test and instructed when necessary, his answers are an indication of his ability to discriminate words that sound alike and are not contaminated by his possible unfamiliarity with the words. No memory for a previously heard word is required. It is one of the "purest" measures of simple auditory discrimination presently available. In the "noisy" conditon, the child makes similar selections of pictures from words that also are pronounced on a tape, but the words on the tape are recorded against a confusing background of noise. The "noisy" subtest thus measures auditory figure-ground function or the ability to discriminate clearly from a "noisy" background, a skill which may be frequently required in school-learning situations.

ITPA--Auditory Sequential Memory. This subtest requires that the child repeat a series of digits after the examiner. It measures short-term memory for a sequence of non-meaningful auditory stimuli. ITPA--Blending. This subtest measures the ability of the child to recognize and repeat a whole word when the examiner pronounces the separated sounds of the word. For example, from "/b/ /a/ /t/," the child must recognize the word "bat." The child must, in other words, take a series of separated sounds pronounced by the examiner and "synthesize" them into a word. ITPA--Auditory Closure. This subtest is somewhat similar to the blending test, but the child must recognize and repeat words which the examiner pronounces by leaving out some of the parts, e.g., "bo - le" for "bottle."

Achievement Measures

Wide Range Achievement Test (WRAT). The word recognition subtest of the WRAT (Jastak, Bijou, and Jastak, 1965) was given to all subjects by school psychologists in the district in January as part of the screening procedures for determining eligibility for Project READ. It was readministered in the Spring. This subtest is an individually administered measure of the ability to give letter names and read words orally. The words are selected from those commonly used in basal readers at each grade level. The words include those most frequently used by the child in his oral language. The test is a more accurate measure of progress in a basal reader than of progress in a linguistic reader.

Gallistel-Ellis Linguistic Reading and Spelling Test (GE). This instrument (Gallistel, Ellis in preparation) is designed to measure mastery of the alphabetic code and application of this knowledge to the recognition of words chosen according to their linguistic structure and according to the sound-symbol combinations they contain. Words are ordered following a progression common to many linguistic readers.

Results

The correlations of aptitudes with pre-test achievement after sight-word instruction and with post-test achievement after phonic instruction are presented in Table 1. It is important to remember that these correlations with word recognition scores are among low readers. Therefore, they indicate the ability of the aptitude to discriminate between really low readers, and not so low readers rather than between low readers and good readers. In addition, since all of the reading scores are of low readers in one grade, the range of both achievement and aptitude scores is restricted which reduces the size of the correlations statistically.

It was hypothesized that low readers with low auditory aptitudes would not do well or would fall out of an intensive phonic approach but get along better under a sight-word approach. It was also hypothesized that low readers with low visual skills would not do well or would fall out of a sight-word approach but would get along better in a phonic approach.

If so, then auditory aptitudes should be more highly correlated with post-test achievement after the intensive phonics instruction characterizing the experimental approach and not correlated or correlated less highly with pre-test achievement after the early sight-word instruction. The data did not support this hypothesis. The upper part of Table 1 reports the correlations of auditory aptitudes with pre-test achievement scores after sight word instruction and post-test achievement scores after intensive phonic instruction. The correlational pattern furnishes some corroboration of judgments as to the effectiveness of each reading achievement measure. Aptitudes are more highly correlated with WRAT scores after sight word instruction. In fact correlations with the GE Test in January are so low as to suggest that it is not an adequate measure of achievement after a few months of sight word instruction. However in May after synthetic phonic or decoding instruction the GE Test is more highly correlated with most aptitudes. This suggests that the GE Test is a more accurate measure of achievement after phonic instruction. Blending was significantly (.01 level) correlated both with WRAT achievement after four months of sight word instruction and with GE Test achievement after four additional months of phonic instruction. The correlations were approximately equal, .354 and .351. Auditory closure was also equally correlated (at the .05 level) with reading achievement after both kinds of instruction —.309 with WRAT after sight word instruction and .302 with GE after coding instruction. The ability to learn to blend after instruction (represented by the post-test blending score) was the most highly correlated with end of first grade achievement after four months of intensive phonic instruction. However, it was also the only aptitude test that was regiven at the time that post-test achievement was measured and thus represents a concurrent rather than predictive relationship. The one auditory aptitude whose correlation was markedly different for pre-test and post-test prediction was in the opposite direction from that which would be predicted by the hypothesis that auditory aptitudes are more important in an auditory or phonic emphasis approach. That is, auditory discrimination was significantly correlated (.01 level) with achievement after sight word instruction and not correlated four months later with achievement after intensive phonic instruction.

The rest of Table 1 presents the correlations of visual aptitudes with achievement. PMA - Space Relations and WISC Coding scores were somewhat correlated (.05 level) with achievement after both sight word instruction and after intensive phonic instruction. Again the one visual aptitude whose correlation was markedly different in predicting sight word achievement compared with achievement after phonic instruction was in the opposite direction from that which would be predicted by the modality strength hypothesis. That is, Visual Sequential Memory (ITPA) was <u>not</u> correlated with achievement after sight word instruction but was significantly correlated (.01 level) with achievement after four additional months of intensive phonic instruction.

Correlations between the various aptitude measures are presented in Table 2. Correlations of auditory measures with each other are in the upper left section, correlations of visual tests with each other in the lower right section, and correlations of visual measures with auditory measures in the lower left section. An auditory aptitude was as frequently correlated with a visual aptitude as with another auditory aptitude. In other words, there was no tendency for auditory tests to cluster with each other nor for visual tests to cluster with each other. This suggests difficulty in classifying children as either "auditory learners" or "visual learners." The correlations between auditory and visual aptitudes were not related to functional categories such as discrimination, figure-ground, memory, and closure. Thus auditory and visual discrimination were not correlated with each other, nor were auditory and visual memory, and so on. The tests which were correlated most highly with reading achievement were also the ones that correlated significantly with other aptitude measures. Blending, for example, was significantly correlated with Auditory Closure, and Auditory Sequential Memory, Visual Perceptual Speed and Space Relations. Auditory Closure was significantly correlated with all aptitudes except Visual Closure and Auditory Figure Ground. It was highly correlated with Visual Sequential Memory and somewhat with WISC Coding scores. These were the aptitudes that were also correlated with reading and spelling achievement at the end of the year.

Table 3 reports the distribution of aptitude deficits among our sample of 58 low readers who had been randomly selected from those who were not achieving well under the sight word instruction normally provided in the classroom. Of these 58 pupils, 33 or 57% received scores that were more than a year below grade level on two or more aptitudes. Since our sample was drawn from the lowest 30% of all readers, 57% x 30% or a projected 17% of all children in first grade in these eight schools might be estimated to have both low reading achievement and scores more than a year below grade level on two or more aptitudes. (Nine aptitude measures -- 5 auditory and 4 visual--were included in this tabulation. Scores from some tests could not be converted to a language or perceptual age.)

Next the characteristics of the children who did not achieve after intensive phonic instruction were ascertained. From the GE test it was possible to determine which children had learned or not learned specific decoding skills. Only 7 of the 58 children sampled had failed to transfer their knowledge of sounds for symbols to the more difficult task of sounding out words they had not learned to recognize by sight. That is, these 7 had failed to achieve a 40% mastery level in reading words in the first GE test category (Section I). These words are made up of single consonants and short vowels. This is a crucial task since if it cannot be mastered it is impossible to progress on the usual phonic-linguistic sequence, whereas once it is mastered it forms a schema into which new sound-symbol relations can be assimilated. The mean aptitudes of the seven children who <u>did not</u> learn the Section I task by the end of 4 months of phonic instruction were significantly lower (.01 level) than the other children who <u>did</u> learn this task on three measures--Blending and Auditory Closure from the ITPA, ~~and WISC~~ Coding. (See Table 4) Mean Visual Sequential Memory scores were somewhat low (.05 level). For two aptitudes, Auditory Closure and Visual Sequential

Memory, the mean of the nonsuccessful group was significantly below the mean of the standardization sample of children of this age. Mean WISC Coding scores for children of this age in the normative sample were not available because of the manner in which these scores are calculated. In the case of Blending, children in our sample, all low readers scored on the average above age norms in spite of the fact that within this low reading group blending scores were the most highly correlated with reading scores. This may have been due to the fact that blending proved to be a highly teachable skill. It is possible that blending skills were taught by the first grade teachers before the project officially commenced. Conversations within each building with teachers of older classes, who had already been instructed in how to teach blending, may have informed first grade teachers of the skills that they were about to begin teaching. Whatever the reason, Blending scores of the unsuccessful decoding group were not as deficient or as far below the standardization norms for their group as were Auditory Closure and Visual Sequential Memory scores.

How predictive were these middle of first grade aptitudes in distinguishing individual children who succeeded or failed at decoding words at the end of first grade? Analysis of Figure 1 reveals the predictive accuracy of Auditory Closure and Visual Sequential Memory singly and in combination. The dotted lines represent the standardization sample score corresponding to the mid-point in the age range for children in that grade. The solid lines represent scores one year below this grade expectancy score. Scores in the lower left-hand corner represent subjects with both visual sequential memory and auditory closure scores more than one year below grade expectancy. Three of the four subjects who failed to learn to decode the first few words (represented in the diagram by an X) fell in this category. All but one of the 11 subjects who failed to achieve the 60% correct level in reading short-vowel words with single consonants scored more than a year below grade expectancy on auditory closure. (This subject scored well below grade expectancy on both auditory closure and visual sequential memory though not a full year below.) All but two of the eleven lowest decoders scored both below grade expectancy on visual sequential memory and more than a year below grade expectancy on auditory closure. However, as can be observed from the number of dots below and to the left of these lines, at least as many children with equally low scores on auditory closure and visual sequential memory succeeded in learning to decode as failed to learn to decode or learned the skill very slowly.

Conclusions and Discussion

The correlational patterns between type of aptitudes (auditory or visual) and type of instruction (phonic or sight word) did not support the hypothesis that achievement in these methods is improved if a child's modality strength is paired with methods that seem to tap this strength. However, this hypothesis was not tested experimentally.

The new Auditory Closure subtest of the revised ITPA seems to be associated with serious difficulty learning to read whether by sight word or phonic procedures. Its correlations with achievements were lower than Blending scores but its mean for the serious nonachievers on decoding skills was the farthest below the normative sample mean. This aptitude was also the most useful in individual clinical prediction. However, from the evidence in this study it is clear that more than 60% of the children with scores as much as a year and a half below grade expectancy on this measure can learn to read by the procedures used in this experimental project. Blending is more significantly correlated with both sight word achievement in mid-year and decoding achievement at the end of the year. Nevertheless, the Blending scores of these low scoring children were not as far below the average of the normative population on which the test was standardized. The Blending scores also did not discriminate as well the children who did not succeed in decoding by the end of the year. This may be because blending skills were taught and proved to be highly teachable. Difficulties in Visual Sequential Memory were characteristic of the small non-successful decoding group but not of the low readers as a whole. More than 50% of our sample of low readers, or 50% of the lowest 30% of all readers in the first grade, were found to have auditory closure scores more than a year below grade expectancy for average youngsters in that grade. These results suggest that three ITPA subtests (Auditory Closure, Blending, and Visual Sequential Memory) as well as WISC Coding may be important variables to control for in experiments designed to evaluate better procedures for teaching the most disabled readers. These subtests may also furnish leads as to procedures designed to help the most disabled. The fact that at least as many children with equally low scores on these aptitude measures did succeed in mastering the first decoding skills should caution the clinician against decisions such as retention or delay in introducing the task based on low scores on these measures. The decoding success of many low aptitude scorers also does not support the hypothesis that adequate performance on these tasks is a prerequisite to success in learning to read. However, successful performance apparently does indicate that success in learning to read is more likely. Further study of these four aptitudes may lead to better procedures for teaching children with low scores on these measures. One word of caution -- programs based on training these aptitudes ought not be launched or advocated until the effects of such training on either decoding or reading achievement are determined.

The fact that 57% of our random sample of low reading first graders or a projected 17% of all the first graders scored more than a year below grade expectancy on at least two aptitudes suggests the possibility that 15% or more of white middle class children may show poor reading achievement in first grade which is related to auditory and visual processing deficits, particularly deficits in auditory closure and blending. In a related study of an older population in these same schools, (Gallistel and Fischer, 1972) 50% of their random sample of low reading third graders, (an estimated 15% of all third graders in these schools) had failed to acquire the first decoding skill of recognizing three letter short vowel words to the 40% correct level at the time experimental instruction began. An estimated 9% of all third graders were seriously retarded in word recognition skills based on WRAT scores. Such findings suggest that a large number of the first grade children in the present study, who were poor auditory or visual processors and poor readers in the middle of first grade, might not have outgrown the effects of these deficits by third grade had they continued in the pattern of previous instruction in the district. Diagnosticians seeking to discriminate the truly disabled 2, 3, or 5% with processing disorders who were not going to learn to decode adequately by third grade under standard educational procedures, could be expected to have great difficulty doing so.

The fact that these low readers did learn to decode when taught to directly suggests that in a majority of these children such processing deficits need not lead to failure to master the code. Such results seem to support the position of Adelmann and Feshbach (1971) that learning problems derive from a combination of learning disabilities (or characteristics in the child) and teaching or school system disabilities.

The data also lend some support to Chall's contention that serious reading disability results not from the child's characteristics alone or from method characteristics alone but from a combination of a predisposition to coding disability and of methods which fail to take account of this disability. The results further suggest that the number of children with characteristics that predispose them to coding disability in similar suburban school districts may be as high as 15%. Such a possibility poses serious problems for special education whose philosophy and administrative reimbursement procedures are predicated on assumptions of diagnosable handicap within the child which are independent of normal educational effects.

It may be that we should spend more time and effort exploring various means for individualizing reading instruction while teaching groups of children either in resource rooms or regular class. The multisensory provisions in the experimental curriculum evaluated in our study may have made it possible for each child and/or his teacher to select the most useful strategies by which he might learn each task. Measures of the achievement of specific skills such as the experimental test we were evaluating may prove more useful diagnostically than measures of aptitude both for individualizing reading instruction and identifying children in need of help in reading and spelling. It may be that we ought to be directing increased attention to the exploration and perfection of techniques for teaching decoding skills to the child who is having difficulty with decoding or who has a disposition to difficulty with this task. These implications and hypotheses must remain tentative until we know much more about the relationship of decoding skills to eventual skill in reading for meaning and until we know much more about the relationships of aptitudes to success at each stage in the learning to read process. Only further study can determine the direction that will lead to the best treatment for each child.

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Table 1

Correlations of Aptitudes with January Achievement after
4 Months of Sight Word Instruction and with May Achievement after
4 Months of Synthetic Phonic Instruction

N=58

	Pre-Test (January)			Post-Test (May)		
Aptitudes Tests Auditory	WRAT Reading	GE Reading	Spelling	WRAT Reading	GE Reading	Spelling
Discrimination & GFW-Silent	.326**	-.067	.160	-.007	.107	.121
Discrimination & Figure Ground GFW-Noisy	.178	.088	-.001	.186	.080	.152
ITPA						
Sequential Memory	.208	.013	.179	.172	.210	.237*
Sound Blending	.354**	.135	.424**	.333*	.351**	.374**
Closure	.309+	-.134	.234*	.200	.302*	.373**
Post-Test Sound Blending	.261*	.075	.292*	.416**	.539**	.555**
Visual						
Visual Discrimination PMA-Perceptual Speech	.096	.030	.042	.229	.108	.226
Visual Space Relations PMA-Space Relations	.262*	-.086	.073	.265*	.174	.186
ITPA						
Sequential Memory	.152	-.026	.089	.230	.360**	.377**
Closure	.061	-.088	-.002	.027	.176	.115
WISC Coding	.237*	.027	.051	.263*	.271*	.300*

* p <.05
** p <.01

Table 2

Correlations Between Aptitudes

Aptitude	Auditory					Visual				
	1 GFW-Q	2 GFW-N	3 ASM	4 Blending	5 A.Cl.	6 Perc.Sp.	7 Sp.Rel.	8 VSM	9 Coding	10 V.Cl.
AUDITORY										
<u>Discrimination</u>										
1. GFW-Quiet										
<u>Figure Ground</u>										
2. GFW-Noisy	.416									
<u>Memory</u>										
3. ITPA-Auditory Sequential Memory	.087	.042								
<u>Processing</u>										
4. ITPA-Blending	.205	.206	.404*							
5. ITPA-Auditory Closure	.388	.144	.293*	.473**						
VISUAL										
<u>Discrimination</u>										
6. PMA Perceptual Speed	.080	.095	.064	.394**	.309**					
7. PMA Space Relations	.301*	.221*	-.003	.310**	.371*	.225				
<u>Memory</u>										
8. ITPA Visual Sequential Memory	.091	.000	.128	.195	.395**	.190	.089			
9. WISC-Coding	.139	.095	-.060	.120	.230*	.304*	.257*	.331**		
<u>Processing</u>										
10. ITPA Visual Closure	.025	.134	.186	.066	.163	.130	.060	.169	.374	
11. Post-Test Blending	.109	.096	.280	.583**	.306*	.128	.297*	.229*	.237*	.163

* $p < .05$
**$p < .01$

Table 3

Number of Pupils in Sample of Low Readers Who Scored More than One Year Below Grade Level on One or More Aptitude[1]

N = 58

More than a Year Below Auditory Aptitudes Only	Number of Pupils
One Aptitude	11
Two Aptitudes	6
Three or More aptitudes	1
	18
More than a Year Below Visual Aptitudes Only	
One Aptitude	4
Two Aptitudes	3
Three or More Aptitudes	1
	8
More than a Year Below on Both Auditory and Visual Aptitudes	
One Each	4
One and Two or Three	13
Two Each	3
More than Two Each	2
	22
More than a Year Below on No Aptitude	10

Summary

More than a Year Below on:	Number of Pupils	Cumulative % of Sample
No Aptitudes	10	100
One Aptitude	15	83
Two Aptitudes	13	57
More than Two Aptitudes	20	34
	58	

[1]Scores on 4 auditory and 5 visual aptitude measures are included in this tabulation. (ITPA-Auditory Sequential Memory, Auditory Closure, Pre & Post Blending, Visual Sequential Memory, Visual Closure; PMA-Perceptual Speed, Space Relations; WISC-Coding). A perceptual or language age was not available for the Goldman Fristoe Woodcock measure of Auditory Discrimination.

TABLE 4

Mean Aptitude in January of Low Readers Who Learned to Code by the End of the Year and Those Who Did Not

	VISUAL					AUDITORY					
	PMA		WISC	ITPA		GFW		ITPA			
	Perceptual Speed	Spatial Relations	Coding	Visual Sequential Memory	Visual Closure	Quiet	Noisy	Auditory Sequential Memory	Auditory Closure	Sound Blending (Pre)	Sound Blend: (Post)
Did not Learn to Decode (n=7) Mean	19.6	18.1	25.6	15.0	19.3	28.0	19.3	23.3	13.0	11.3	16.9
S.D.	1.8	1.8	6.0	3.9	4.7	1.6	3.1	3.8	2.7	2.7	3.6
Equivalent Psycholinguistic Age:	Not available			5-7	6-1	6.0	6.2	6-3	4-11	5-10	7-4
Did Learn to Decode (n=51) Mean	22.0	19.1	37.1	19.1	22.1	28.2	19.2	23.5	17.5	16.7	23.9
S.D.	3.5	2.8	8.4	3.6	4.5	1.9	2.9	7.2	4.0	4.8	3.5
Equivalent Psycholinguistic Age:	Not available			6-10	6-9	6.0	6.2	6-3 to 6	5-9 to 6-1	7-4	Above Norm
t between n=7 and n=51	1.7	1.1	4.2**	2.5*	1.4	.2	.0	.1	3.2**	4.3**	4.6*
Standardization Sample	Not available										
Mean				18.6	22.4	28.43	19.88	24.9	20.0	15.3	15.3
S.D.				3.1	4.9	1.53	3.05	6.2	3.5	4.9	4.9
t between Mean Non- Decoders and Standardization Sample				3.0**	1.6*	-.7	-.5	.7	5.1**	2.1*	.5
t Between Other Low Readers and Standardization Sample				.9	.4	-.7	-1.2	1.3	4.0**	1.8*	10.4** Above Norm

* $p < .05$
**$p < .005$

1) The equivalent psycholinguistic ages for the GFW are interpolated from a table of percentile scores to middle of score intervals since they were not available from the authors.

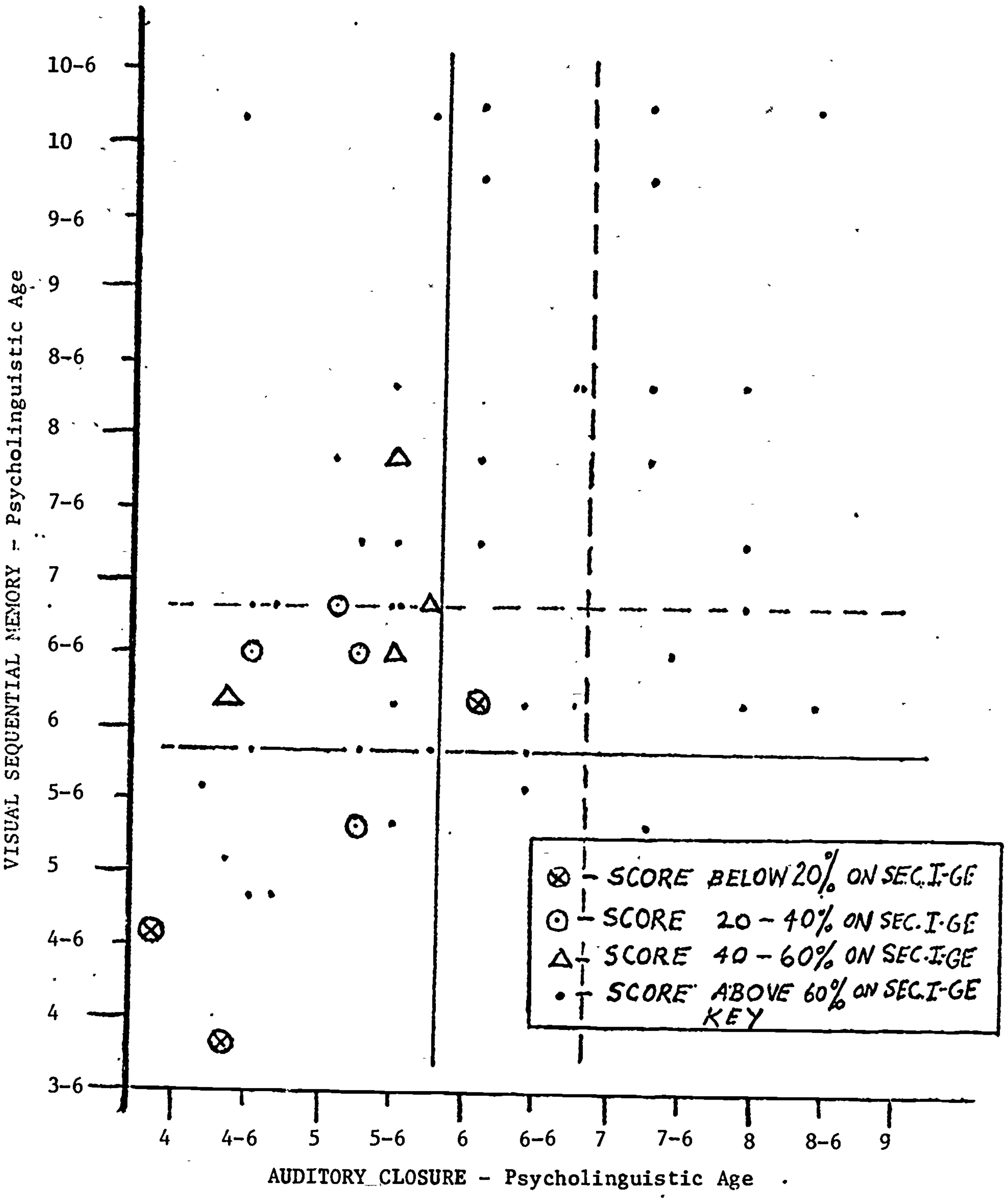

Fig. 1 - Predictive Accuracy of Auditory Closure and Visual Sequential Memory