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ABSTRACT

An attempt was made to ascertain whether, for boys with a specific reading disability, a word recognition task would be facilitated by a method which placed emphasis on the S's stronger perceptual modality.

On the basis of the Embedded Figures test (Spreen & Benton, 1969) and the Meikle Consonant Perception test (Meikle, 1970), 30 boys were divided into three perceptual groups (average on both tests, low on the visual test and average on the auditory, and low on the auditory and average on the visual). Two word lists were taught to each S individually by two methods. The Visual method emphasized visual cues and the Auditory method placed emphasis on the phonetic aspects of the words. Repeated measures analyses of variance were carried out on the four measures collected: Trials to Criterion, Time to Criterion, Recall, and Words per Minute.

Results revealed that there was no Method x Group interaction. The Visual method appeared to be more effective for all groups than the Auditory method. Possible reasons for the findings were discussed: (a) the Auditory method was seen to be more difficult than the Visual, (b) the word recognition task did not appear to be demanding

enough to demonstrate Method x Group differences if these did exist, and (c) it was felt that lack of group homogeneity on age and IQ variables may have influenced the results, although a post hoc analysis of three groups matched on Performance IQ showed the same pattern of differences as the original groups. A further post hoc analysis of two groups homogeneous for age, IQ, and severity of reading disability showed some support for the hypothesized facilitation of learning.

Recommendations for future research included the need for clarification of (a) the relevant dimensions of group homogeneity, (b) the visual and auditory components essential to the reading process, and (c) the relationship of functions tapped by perceptual tests to the reading process. The inclusion in the design of a measure of learning process in addition to the traditional measure of recall was found to be important for providing additional clarification of results.

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Introduction

It has been recognized for many years that there exists in the general school population a group of children who, although coming from a normal environment, receiving standard teaching, and possessing adequate intelligence, are unable to learn to read with normal proficiency. Many writers in the field have been concerned with this problem and have generated a number of terms to label the condition. Cruikshank (1968) identified 43 such terms. Among those more commonly used are learning disability, minimal brain damage, dyslexia, educational handicap, minimal neurological dysfunction, and psychoneurological learning disorders. The definitions of these terms depend on the medical, psychological or educational orientation of those generating them but there is considerable overlap in the behaviours they describe. Kirk (1968) perhaps best sums up the various definitions: "A learning disability refers to a specific retardation or disorder in one or more of the processes of speech, language, perception, behaviour, reading, spelling, writing or arithmetic [pp. 1-2]." Educational retardation seems to occur most frequently in the area of reading (Bateman, 1964). A specific reading disability has been defined by Eisenberg (1966) as ". . . the failure to learn to read with normal proficiency despite conventional instruction, a culturally adequate home, proper motivation, intact senses, normal intelligence and freedom from gross

neurological defects [p. 352]." When reading retardation is present despite adequate functioning in all these areas it is classified as a "specific reading disability" (Myklebust, 1967; Silver & Hagin, 1967). When, however, any primary contributing factors are present, whether physical, mental, emotional, cultural or educational, a diagnosis of nonspecific reading disability will be made.

"Failure to learn to read with normal proficiency" is consensually defined as a reading level two or more years below grade level in the upper grades although a retardation of even one year is considered diagnostically significant in the first three grades by Bateman (1965) and Boder (1971) and six months in grades one and two by Kaluger and Kolson (1969).

It can readily be seen that estimates of incidence of specific reading disability will vary according to the operational definition used for reading retardation. Bateman (1964) feels that a conservative estimate would be 5% to 10% of the school population. Critchley (1970) suggests 10% as a reasonable figure.

It has been consistently found that along with birth trauma, infant mortality, and behaviour disorders, the incidence of learning disorders is higher for boys than for girls. Critchley (1964) reported that the male to female ratio is between 3:1 and 5:1 in most large studies. Koppitz (1971) found that the overall ratio of boys to girls in a

public school learning disorder program was 6:1. Again, as in the case of incidence estimates, the cut-off point chosen to designate retardation in reading will affect the ratio. If it is "in the mild dyslexic area the ratio of boys to girls may be 3:1 or 4:1; in the very severe cases the ratio may rise to 10:1 [Bannatyne, 1971, p. 22]."

It follows from the definitions that in the presence of a retardation in reading, a screening process will first be necessary to rule out other possible reasons for the failure to learn. Boder (1971) refers to this process as "diagnosis by exclusion." Positive findings may then be sought in order to confirm the diagnosis of a specific reading disability. There is a certain amount of overlap to be seen in the approaches of the various disciplines. However, different types of evidence are typically associated with orientations that stress neurological, psychological or educational data (Boder, 1971).

The neurological approach is to look for the minimal signs or associated developmental disorders which have often been found to accompany specific reading disability. Both clinical and educational psychologists use psychometric test results as a basis for diagnosis. Clinical use has revealed that particular patterns of results are frequently associated with learning disabilities. In particular a discrepancy of one standard deviation (SD) or more between Verbal and the Performance Scale scores on the Wechsler

Intelligence Scale for Children (WISC) is usually considered to be diagnostically significant (Clements & Peters, 1962; Ingram & Reid, 1956; Bannatyne, 1971). The educational approach is primarily to determine what specific skills are lacking in the child in order to facilitate prescriptive teaching (Bateman, 1965). The neuropsychological approach to diagnosis integrates the information obtained from neurological, psychological, and educational evaluation. The understanding of the individual's cognitive, perceptual and motor functioning so gained is used as a basis for remedial planning (Gaddes, 1968).

As work has progressed refining diagnostic procedures to identify learning disabilities, it has become apparent that the category is not one homogeneous group. Ingram and Reid (1956) attempted to differentiate children with developmental dyslexia on the basis of WISC scores and identified two groups. The low verbal group (low verbal score relative to performance score) showed more errors of an audiophonic type in reading and spelling while the low performance group tended to make more errors of a visuo-spatial nature. A third group, exhibiting errors of both types, was severely educationally handicapped.

The work of Kinsbourne and Warrington (1966) confirmed and extended these findings. They too identified two groups of dyslexic children. Group 1, designated as the language retardation group, demonstrated a low verbal score on the

WISC relative to the performance score and a high frequency of associated slow language development. Group 2, on the contrary, showed a relatively low performance score along with impaired finger differentiation, impaired performance on construction tasks and difficulties with arithmetic.

Using a direct analysis of reading and spelling errors to diagnose reading disability, Boder (1966) also identified three groups, one making primarily audiophonic errors, one making visuo-spatial errors and a severely handicapped group showing both types of errors. Bannatyne (1971) also identified two distinct groups of children with reading disability. One group, the "genetic dyslexics," he considered to be at the lower end of a continuum of verbal ability in the normal population. Such children will often have difficulty in fine auditory discrimination, auditory sequencing and association of auditory and visual symbols. This group seems similar to the group Boder (1966) identified as making audiophonic errors in reading. The second group was classified as children with minimal neurological dysfunction, showing a variety of disabilities of a visuo-spatial, auditory, motor or integrative and conceptual nature. From this group the children making visuo-spatial errors would be equivalent to the visuo-spatial groups identified by Boder (1966), Ingram and Reid (1956) and others.

Along with the work on diagnostic clarification much

clinical time had been spent in efforts to remediate reading disabilities. Boder (1966), Ingram (1970), and Johnson and Myklebust (1967) all feel that dyslexic children read and spell differently than do normal children. Boder (1971) has found that children who are not dyslexic, that is who have a nonspecific reading retardation, tend to exhibit normal patterns of reading and spelling. Although they may be reading one or two years below their expected level they read and spell like a normal child one or two years younger than themselves. The errors in spelling made by a normal child are usually recognizable phonetic attempts at the word. The child with specific reading disability exhibits different types of errors. Boder classifies them into two main types, those having an audiophonic basis and those having a visuo-spatial basis. In the first type of error the letters written bear little or no relationship to the sound of the word. The attempt usually produces a word which is unrecognizable even by the child himself. The second type includes letter reversals and misplaced letters. While conventional teaching methods may be appropriate for nonspecific reading retardation, cases of specific reading disability may require special methods of remediation.

Work in the general area of individual differences and the development of the neuropsychological approach to diagnosis of reading disabilities have both directed remedial prescriptions more and more to take into account

specific strengths and weaknesses in perceptual modality functioning. Chalfant and Flathouse (1971) applied an information-processing model to the study of learning disabilities and concluded that teachers would be greatly helped in planning individualized instruction if they knew what kinds of stimuli were best analyzed by the child. Johnson and Myklebust (1967) and Boder (1971) suggest remedial methods directed to the stronger perceptual mode. Others (Bateman, 1968; Frostig, 1967) suggest strengthening deficit perceptual areas as well ". . . by matching remedial techniques to specific deficits; these must also be reinforced in every way possible through the child's intact areas [Bannatyne, 1971, p. 640]." The direct stimulation of deficit perceptual areas by specific exercises is advocated by Silver and Hagin (1972).

Methods for the remediation of reading disability have been classified by Myers and Hammill (1969) according to the primary orientation emphasized in the instruction. For example, they have identified, among other methods, the Phonics systems in which the main emphasis is on the auditory characteristics of words.

The Gillingham method (Gillingham & Stillman, 1960) is an example of a phonics method, one which relies primarily on auditory-visual and visual-auditory associations between sounds and letters or letters and sounds. This method first presents the associations between letters and sounds,

teaching the name of the letter and then its sound. The child says the name of each letter as he writes it. When the associations are well established, blending the sounds into words is begun. When he can say any three letter word, short stories are composed for the child to read.

Myers and Hammill (1969) make no mention of the 'look and say' method in which words are learned as visual gestalts, since it has generally not been considered a specialized remedial approach but rather an initial teaching method for building a sight vocabulary. However, both Boder and Myklebust consider this to be the remedial method of choice for children with good visual but low auditory perceptual skills.

The method developed by Fernald (1943) is the best known of the multisensory methods. In the early stages equal emphasis is placed on the visual, auditory, kinesthetic and tactile modalities. In practice, matching remedial methods to perceptual mode strengths or weaknesses relies on the ability to assess levels of modality functioning. For this purpose neuropsychological test batteries commonly include tests of perceptual functioning in the visual, auditory, tactile and kinesthetic modes.

Virtually every school system makes some provision for the remediation of reading disabilities. Remedial programs have been established within school systems and in special clinics. Emphasis is usually on individual or small group

instruction for a few hours per week with the child .
returning to his own classroom for most subjects. In some instances, full-time remedial classes have been established (Cruikshank, 1961; Koppitz, 1971). Given the widespread nature of remedial programs, relatively few efforts have been made to evaluate their effectiveness. Reed, Rabe and Mankinen (1971), limiting their survey to the literature relating to neurological dysfunction and reading, and to the decade from 1960 to 1970, found only seven studies which ". . . were honest efforts at experimental investigation of the efficacy of a particular method or methods of instruction [p. 102]." They included for review any article which contained in its title the term dyslexia, perceptually handicapped child, minimal cerebral dysfunction or "one of the multitudinous synonyms." Of 101 articles chosen as being directly related to their purpose, they found that 36 were discussion papers on learning disabilities, 23 were descriptive studies of dyslexic children, and only 42 pertained to remedial methods for this category of children. Of these latter, 33 described methods with no attempt to assess their merit, and only 7 were attempts at evaluation.

A great deal of time and effort is being expended on remediation of reading disabilities with few systematic attempts to evaluate the success of such work. Frequently remedial prescriptions are based on an evaluation of the child's sensory mode functioning without proof of the

effectiveness of this approach. Therefore, it will be the purpose of this study to evaluate one specific remedial approach, namely the matching of method of remedial instruction to perceptual mode strengths.

Review of the Literature

This chapter will discuss work in the literature related to (a) the evaluation of remedial reading programs, (b) research matching a remedial method to perceptual strengths or weaknesses, and (c) methods of initial reading instruction matched to the learner's sensory mode strengths.

Some studies evaluating remedial reading programs.

Reed, Rabe and Mankinen (1971), in their survey of the literature, found only seven studies which were attempts at evaluation of methods of remediation. Three of these studies were omitted from this discussion because the population studied showed severe emotional disorders, mental retardation or gross neurological deficit and so by definition were not relevant to a discussion of specific reading disability. Of the remaining four studies, those of Cruikshank, Bentzer, Ratzeburg and Tannhauser (1961), Talmadge, Davids and Lauffer (1963), and Weiner (1969) will be discussed in this section. The work of Silver, Hagin and Hersh (1967) will be discussed in a later section. In addition to the work surveyed by Reed et al., six additional studies were found which attempted to evaluate general remedial programs in schools and learning centres. This section, then, will describe briefly nine attempts at evaluation and their findings.

Evaluation of a specific classroom environment and a

structured program for children with behavioural and neurological signs of central nervous system (CNS) dysfunction was the concern of Cruikshank et al. (1961). Two experimental groups and two control groups were formed from children referred to special education classes because they were not achieving at their maximum potential. Groups of 10 subjects (Ss) each were matched for chronological age, mental age, achievement levels, and degree of hyperactivity. The experimental groups were given a nonstimulating classroom environment and a strictly prescribed teaching method using a wide variety of techniques. The control group appeared to receive standard remedial class approach, although this was not specifically stated. Evaluation of intellectual, perceptual and academic tests was carried out at the end of the one-year program and again at the end of a second year after the experimental and control classes had been regrouped and the teaching approaches varied. On perceptual tests and social maturity scales the experimental group made only temporary gains over the control group at the end of the first year. Both groups made significant academic improvement.

Talmadge et al. (1963) studied a group of children in a residential treatment centre for emotionally disturbed children. The Ss, all showing a reading retardation of two or more years, were divided equally between the experimental and the control group for a three-month program of

individual instruction. The control group was taught by traditional methods. The experimental group used a kinesthetic-auditory approach (cf. Fernald [1943] but with phonics applied). The teaching sessions lasted approximately one hour a day. The mean improvement score for the experimental group was almost twice that of the control group. Talmadge et al. give no indication as to the homogeneity of the group in respect to visual, auditory and motor deficits. Since, however, the program encompassed visual, auditory and tactile input it is conceivable that the emphasis on one mode or the other may have shifted according to the strengths of the individual being taught.

Other research has been carried out into the effectiveness of remedial programs within the school system. The use of resource rooms as a means of helping children with specific reading disabilities was investigated by Weiner (1969). Four different resource rooms staffed by four remedial teachers were used. The Ss, ranging from 7 to 12 years of age, had all failed the previous year's work. They came to the rooms to work individually or in small groups for part of each day (preferably at the time their regular class was working on reading). The rest of the time was spent in the regular classroom. Methods used by the remedial teachers were described as being eclectic. All groups were reported to show a significant improvement between pre- and post-testing on the Wide Range Achievement

Test (Jastak & Jastak, 1965) and the Bender Gestalt (Bender, 1938).

It is not clear from the report what was meant by the term "significant improvement." Was it enough to pass the repeated year? There seems no way to ascertain from this design whether the improvement was due simply to repeating the year's work, becoming a year older, or because of the individual attention received from the resource room teacher. Although the methods were stated to be eclectic, there is no way of knowing if a planned attempt was made to match methods to specific individual perceptual strengths.

Collins (1961) attempted to evaluate the relative effectiveness of attendance at a remedial centre and special tutoring within the school for Ss showing specific reading disability. Three groups of 20 Ss each (10 boys and 10 girls) were randomly assigned to groups attending the remedial centre, groups treated at school by travelling tutors or the control groups which continued to receive ordinary teaching. Over a period of six months, remedial teaching was given in groups of four on one afternoon and one morning per week for approximately 75 hours of remediation. A mixed approach to remediation was used, including the memorization of sight words and phonic exercises. At the end of the remediation period both experimental groups were significantly ($p < .01$) improved over the control group. There was no difference between the

two experimental groups. One and two year follow-up, however, revealed that the treated groups' advancement was no different from the progress of the controls. "The long-term effects of treatment were negligible [p. 65]." No apparent attempt was made to identify perceptual weaknesses or match methods to strengths.

Lovell, Byrne and Richardson (1963) compared two groups of 50 children who were matched for age, reading quotient (reading age/chronological age X 100), sex and, as far as possible, intelligence and school. Both had been referred to the full-time remedial centre but the control group did not attend. The experimental group spent an average of .9 years at the centre. After a minimum of 16 months back in the regular school, two reading tests were re-administered. There was no difference in the reading quotient (RQ) of the two groups.

Lovell et al. (1963) also compared two groups of pupils who both attended the remedial centre. By considering an RQ of 85 or below to designate a backward reader, they discovered that they also had a group referred for remediation whose RQ was above 85. They designated this group as the nonbackward group. Lovell et al. felt that this group had been referred because of a mental age/reading age discrepancy. Both groups were found to make the same progress per unit time. The RQ rose but fell again markedly in the period after remedial teaching ended so that at

follow-up the quotient was roughly the same as at referral.

Again, in these two studies there is no indication of the type of remedial work carried out.

In an attempt to evaluate a school system's reading centre, Buerger (1968) compared Ss who attended the reading centre over a three year period with a group who did not receive formal remedial training during the same time. Groups were comparable for mental ability and reading performance. The remedial instruction consisted of one-hour sessions two or three times a week for an average period of 15 months. Methods consisted of a variety of instructional approaches according to the individual needs. Pupils in the remedial program showed significant remedial gains. However, on follow-up, which ranged from .3 to 5.6 years after the end of remediation, it was found that they did not make greater long-term progress than the control group.

Balow (1965) summarized the findings of three studies carried out in a clinic for diagnostic and remedial education services. Ss were boys and girls (ratio 4:1), aged 10.6 to 12 years with average or better IQ and achieving 3 years or more below expectancy in reading. The remedial program was carried out primarily in the summer over a 10 week period. Individual and small group instruction was given for 2 hours per day. Methods were described as "a thoroughly eclectic outlook, vigorously pursued." Reading growth was expressed as a ratio, months of reading growth/months of instruction

where a month of instruction is equated to 20 days of 2 to 3 hours of daily instruction. The rate of growth for a normal pupil would be equal to 1, that is, one month's growth for one month's instruction. In these three studies pre-remedial growth was about half the rate of normal pupils (ratio = .56). During the remedial period progress was 12 times regular class rate for sample 1 (ratio = 6.61) and 9 times for sample 2 (4.79). This figure was not available for sample 3. In the follow-up period, samples 2 and 3 received some supportive help and the rate of growth continued at about 75% of normal (ratio = .75). The type of supportive help was not specified. Sample 1 had no further help and the ratio of growth dropped to $-.01$. This group did not continue to develop in regular classes without further support. Balow feels that these findings suggest that a long-term approach to remediation is needed rather than a short-term intensive course of treatment.

Further support for Balow's position is to be seen in a study carried out by Heckerl and Sansbury (1968). They followed six adolescent boys through three years of daily remedial sessions of one and one-half to two hours per day, including summers. The boys were taught as a group using methods devised by Fernald (1943), Gates (1947), and Gillingham (1960). It was not explicitly stated that remedial methods were matched specifically to individual strengths. However, the authors did state that at times the

group was subdivided because in a group situation the use of methods developed for individual children depended on homogeneity of learning deficiencies.

At the beginning of the study the boys ranged in age from 11 to 14 years and all six were reading at least four years below grade placement. The mean initial oral reading score for the group was 1.8. After three years of remediation it was 5.0. The boys then returned to public school programs which did not provide further remediation. At follow-up two years later the reading score had dropped slightly to 4.7 and silent reading, spelling, and arithmetic scores showed only minimal gains. This result seems in line with Balow's conclusion that continued remedial support is needed if progress is to continue.

The findings of a five year follow-up study led Koppitz (1971) to a similar conclusion: that continued support in a remedial program may be necessary for some children to make continued progress. Koppitz studied the first 177 pupils (ages 6 to 12) to be enrolled in a new public school program for children with learning disabilities. Forty per cent of these ss were still in the learning disabled (LD) classes at the end of five years and others were followed as they moved to different classes within the school system. Koppitz found that the 7 to 12 year olds made the most progress during their first year in the program, and that "this initial rapid rate of progress is rarely maintained during

the next few years in school [p. 64]."

It is difficult to tell what special remediation was carried out in the program Koppitz evaluated. She speaks of teaching methods "varying from class to class and from one age level to the next [p. 6]." The only perceptual test mentioned was the Bender Gestalt test, a test of visual-motor performance, which was administered to only 24 of the pupils. One gains the impression that the remedial groups were in effect heterogeneous and that one main method of remediation was used in each class according to the preference of the individual teacher.

In summary, it can be seen that, with one exception (Weiner, 1969), the studies so far reported used a control group or collected follow-up measures or used a combination of these two methods in an attempt to evaluate remedial programs. Three of the studies (Buerger, 1968; Collins, 1961; Cruikshank, 1961) used both methods and they found that although the experimental groups showed immediate gains as a result of remedial work, by the time of follow-up there was no difference between remedial and control groups. One study (Talmadge et al., 1963) used a control group but carried out no follow-up measure. He found significant immediate gains for the experimental group. Lovell et al. (1963) used a control group and took a follow-up measure only. They found no difference between remedial and control groups. Balow (1965) and Heckerl and Sansbury (1968), in

long term studies, in effect using each group as its own control, found gains in rate of reading growth at the end of remediation but at follow-up saw a severe drop in growth rate unless continued support was given. Koppitz (1971) carried out a longitudinal study and found a spurt in learning in the first year which did not continue at the same rate over the five years the study was continued.

The general tenor of the research reviewed so far indicates immediate gains for the remedial groups which do not hold up after remediation is terminated. Silberberg and Silberberg (1969) suggest that one reason for the immediate increment and its subsequent decline is the possibility that in an experimental or evaluation situation skills are taught which are directly related to the criterion instrument but which do not carry over to the actual reading process.

Another explanation of the immediate gains reported as a result of remedial intervention has been suggested by Koppitz (1971). She, in fact, feels that this initial spurt in learning may be in part illusory. Koppitz found that often it was not new learning that was being demonstrated but previously learned work that the child had been unable to produce because of loss of confidence and motivation. Once placed in the small and protective LD classes, released from pressure and the continuous feeling of failure, children for the first time were able to work up to their capacity. Extra attention and special materials helped him

to do his best, "but once a child was working up to his ability he did not advance beyond that level at any other than his own natural rate of progress [p. 188]."

Thus Koppitz has suggested a reason for the initial spurt in learning seen in virtually all remedial programs. A reason for the diminishing returns subsequently seen has perhaps been given by Collins (1961). He evaluated the remedial program that was in effect during his study, and came to the conclusion that despite the individual attention given, the methods employed did not differ in any essential way from those used in the regular teaching situation and so brought no positive force for change. Examining the other studies cited, it is often impossible to determine what specific techniques were used. This lack of concern for remedial methods on the part of those reporting the investigations would lead to the conclusion that no specific methods were being considered and, therefore, that regular teaching techniques were being employed.

Studies matching remedial methods to perceptual strengths or weaknesses. In view of the evidence from diagnostic studies, it is surprising that a great deal of the remedial work under evaluation seems to have been carried out on the assumption that children with a specific reading disability form one homogeneous category. At best it seems that the research previously discussed made only incidental provision for the use of different methods with

different children. Only four studies were found (Anderson & Stern, 1972; Bursuk, 1971; Neville, 1971; Silver, Hagin & Hersh, 1967, 1972) which were specifically concerned with matching remedial methods to perceptual strengths or weaknesses. This section will report these studies and their findings.

Silver et al. (1967, 1972) were interested in developing and assessing teaching methods specifically directed toward remediating the perceptual deficits which may contribute to reading disabilities. They devised means of stimulating deficit perceptual areas to see if modification of perception was possible and whether such modification contributed to reading achievement. They studied boys, aged 7 to 11 years, referred to a Mental Hygiene Clinic because of learning and behavioural problems, who were reading at least one year below their expected level.

A profile of perceptual assets and deficits was drawn up for each boy and treatment was divided into two parts. Fifty sessions were devoted to specific training of accuracy of perception in the deficit perceptual areas and fifty sessions were taken up with "contact appointments." The appointments, designed to control for the effect of individual attention on reading achievement, comprised standard reading instruction in a basal reader. Apart from two 45-minute individual sessions held each week, each S

spent the day in regular classes of a public school. One group received the perceptual training series first and then the "contact appointments." The other received the treatments in the reverse order.

Results indicated that stimulation of deficit perceptual areas resulted in generally improved perception in those areas and suggested that improved perception led to improved reading without direct remediation. It appeared that when deficits were trained first, reading instruction had a better chance of success.

Some findings which do not agree with those of Silver et al. were reported by Anderson and Stern (1972). They studied second grade children who were reading three months or more below expectations and who were low (a quotient of 90 or below) on the Frostig Developmental Tests of Visual Perception (Frostig, 1961). Three treatment groups were formed. The Visual Perceptual group received training which adhered strictly to Frostig training procedures. The Corrective Reading group was given reading instruction in 13 skill areas such as identifying upper and lower case letters and recognizing final consonants. The Attention-Placebo group took part in supervised sessions of games and contests. Ss were randomly assigned to treatment groups and randomly assigned to teachers within groups. Treatment was carried out in groups of three or four pupils, 30 minutes a day for 16 weeks. Measures of visual perceptual ability and reading

were taken. No difference between groups was found on the amount of test score change on pre-mid, mid-post, or pre-post testing of silent or oral reading. Anderson and Stern's general conclusion was that this study gives ". . . little, if any, support for the use of the Frostig program or corrective reading as treatments to improve the reading skills of children considered to possess a visual-perceptual problem. Due to the performance of the attention-placebo group, it is logical to hypothesize that the improvements of the perceptual and reading groups were more a function of personal attention than the unique remedial powers of the two treatments [p. 393]."

This finding supports the conclusion of Koppitz (1971) as to the effects of extra attention in the remedial situation. One reason for the disagreement with the findings of Silver et al. (1972) may be that Anderson and Stern worked only with visual-motor deficits while Silver et al. attempted to remediate any identified perceptual deficits.

The two preceding studies looked at direct remediation of perceptual deficits but Neville (1971) was interested in assessing the effects of methods of teaching word recognition which were aimed at the reader's modality strengths or weaknesses. Neville devised the Test of Modality Aptitude for Reading (TOMAR) by adapting the Mills Learning Methods Test (Mills, 1955) for use as a group test.

Third grade pupils who were reading one year below their expected level were classified on the TOMAR as having a modality strength, a modality weakness, or "no pattern" (who learned equally well through all modalities). Three instructional groups were formed. The Visual group stressed visual aspects of word recognition, the Auditory stressed sound cues and the Kinesthetic used tracing as an attentional device. Visual classes were composed of Ss showing visual strength, visual weakness and randomly assigned "no pattern" Ss to bring the class size to 15. A similar procedure was used to fill the other two groups. The results indicated that groups taught according to strengths and the "no pattern" groups showed significant gains between pre- and post-tests of word recognition whereas groups taught according to their weaknesses did not show significant improvement.

It was not clear from Neville's report how long the remedial instruction was carried out, nor whether these Ss were grouped solely for remedial reading or were in full-time classes. Details of the remedial methods were not included nor was it made clear whether or not teachers were aware of their students' ratings on the TOMAR.

A similar result was found by Bursuk (1971) working with adolescent students. She found a significant interaction between sensory modality learning preference and two types of remedial instruction emphasizing different

sensory modes. Ninety adolescent pupils who all had a retardation in reading were classified according to sensory modality learning preferences on the basis of Sequential Tests of Educational Progress, Reading Form 2A (Educational Testing Service, 1959). Remedial instruction was given three times a week for one semester. A combined aural-visual approach was used with the experimental group and a conventional, predominantly visual approach was the control method. Equal numbers of each type of learner (visual, auditory or no preference) were randomly assigned to the experimental or control conditions. The experimental group showed significantly greater growth in reading. The experimental approach proved to be more effective with those SS who showed an auditory learning preference while the control approach was more effective with the learners who had a visual preference.

In summary, two studies looked at the effects of attempting to remediate perceptual deficits and reached contradictory conclusions. Two studies attempted to remediate the reading deficit directly and assessed the effects of presenting instruction to the strong or weak modality. They found that teaching to strengths was more effective.

Studies matching initial reading instruction to sensory mode preferences. The research discussed so far has been concerned with children showing a reading deficit. Other

researchers have been interested in individual differences in perceptual mode functioning as they relate to beginning readers. The work of six (Bateman, 1968; Bruininks, 1968; de Hirsch, 1966; Harris, 1965; Robinson, 1972; Waugh, 1973) will be discussed in this section.

Harris (1965) attempted to individualize first-grade reading instruction according to specific learning aptitudes. Four groups were formed on the basis of the Bender Gestalt test (Bender, 1938) as a measure of kinesthetic ability, the Gates Visual Performance test (Gates, 1939) as a measure of visual performance, and the Gates Rhyming test (Gates, 1939) as a measure of aptitude for phonics instruction. The Phonics experimental group was low on the visual test and higher on the rhyming while the Phonics control group was low on both. The Kinesthetic experimental group was low on the visual and higher on the Bender test while the Kinesthetic control group was low on both tests. Regular class instruction was supplemented with either phonics or kinesthetic instruction according to group. The 20 Ss taking part in the research did slightly better than was expected but there was no significant association with method or presumed aptitude, in fact the control groups tended to do better than the experimental groups.

It appears that these Ss were not actually taught using a method matched to aptitude since the supplemental instruction was given only twice weekly. The methods and

procedures used and the length of time the sessions lasted were not specified. The results seem to support the views of Koppitz (1971) and Collins (1961) on the effects of individual attention.

An attempt was made to assess whether matching teaching methods to the auditory and visual perceptual strengths of economically-disadvantaged grade two and grade three boys would facilitate the learning of new words. Bruininks (1968) divided his Ss into two perceptual dominance groups on the basis of performance on a battery of perceptual tests. One group demonstrated strengths in visual perception and weaknesses in auditory perception. The other showed the reverse pattern. The IQ of the group ranged from 70 to 110. Each S was taught 15 words by a look-and-say (visual) approach and 15 by a phonics approach. The two individual teaching sessions each lasted 23 minutes. The learning criteria were the number of words correctly recognized immediately following the lesson and one week following. Contrary to Bruininks' expectations, the Ss learned equally well if taught to their strength or their weakness. There was an overall trend for the visual method to be more effective regardless of the Ss' perceptual characteristics. No mention was made of the methods currently in use in the Ss' regular classrooms. It is possible that the trend to the overall effectiveness of the visual method may have been due to familiarity with this method.

On the contrary, an overall superiority for the auditory method regardless of the modality preference of the Ss was found by Bateman (1968). She compared a visual approach to first-grade reading with an auditory approach for children either homogeneously grouped by preferred learning modality (auditory or visual) or heterogeneously grouped with no consideration of modality preference. Homogeneous groupings were made on the basis of scores on the Illinois Test of Psycholinguistic Abilities (Kirk & McCarthy, 1961). Two of each type of group were taught by an auditory method (the Lippincott beginning program) and two each were taught by a visual method (the Scott-Foresman series). At the end of grade one Gates reading tests were administered to all classes. The auditory method was found to be superior to the visual method, regardless of the modality preference of the S. Ss who preferred the auditory modality were superior to those who preferred the visual. No interaction was found between preferred modality and method of instruction. In contrast to Bruininks' group, Bateman's Ss were drawn from a high socio-economic level and were a highly intelligent group (mean IQ 120). In addition, Bateman's Ss were taught year-long by one method whereas Bruininks used a very short experimental intervention so the two studies are not directly comparable.

Robinson (1972) was concerned that the selection criteria of Bateman may not have identified truly auditory

or visual learners. Robinson categorized her Ss as being high or low on visual perception tests only if they scored consistently above or below the median score on all three of the visual perception tests used. In the same way, Ss were classified as being low or high on the auditory discrimination test if they were below or above the median. The pupils who met Robinson's criteria for inclusion in the study were never identified for the teachers.

Two school systems participated in the study. One system used a phonics method for teaching beginning readers and the other used a visual method. One condition for permission to carry out the study was that no overall comparison of the two methods would be made. Analysis of reading results at the end of grades one and three revealed that children who had scored high in both modalities achieved higher reading scores than those who scored low on one modality, while those low on both modalities made the least progress. Neither a phonic nor a sight method was found to be more effective with any of the modality groupings.

Of the four studies described which attempted to match early reading instruction to sensory mode strengths none found any interaction of sensory mode strength with method. One study made no attempt to compare the overall effectiveness of one method over the other. Of the other three, one found the auditory method better, one found the

visual method to be better, and one found no difference between methods.

Reviewing this work of Bateman, Harris, Bruininks and others, Waugh (1973) felt that their lack of support for matching method to perceptual mode strengths may have been influenced by the measurement problems inherent in classroom research. He therefore attempted to relate modality preference to performance in a more controlled presentation of material through the visual or the auditory mode. Waugh identified 27 Ss with an auditory preference and 27 Ss with a visual preference by testing 166 grade two pupils on the Illinois Test of Psycholinguistic Abilities (ITPA). Since group teaching was used, experimental procedures were administered to all children in the five classes studied. Lists of words were taken from the Teacher's Wordbook of 30,000 Words (Thorndike & Lorge, 1959) at the level recommended for teaching to third grade pupils. One list of 10 words was taught with the emphasis placed on visual presentation. The second list of 10 words was presented with the emphasis on auditory cues. At the end of each instructional period each word was pronounced and the S was asked to circle the correct one of four alternative words. Results revealed that there was no difference between individual S's auditory and visual recognition. Those Ss classified as auditory learners achieved higher scores by both auditory and visual methods than did the visual

learners. Waugh concludes, "the premise that certain children have a preferred modality that facilitates recall and recognition of words is not supported by these data [p. 469]."

Such facilitation may possibly have been obscured by two factors which Waugh does not seem to have considered. There was no control mentioned for the possibility that some of the words may have been known to the Ss. The fact that they were selected from a level suggested for teaching to third grade students does not ensure that second grade pupils did not know them. The second possibility lies in the fact that recognition tasks are easier than recall (Kintsch, 1970). This may have led to a ceiling effect which could mask differential results due to modality of presentation.

Examination of the studies by Bateman and Waugh raises two points for consideration in a discussion of specific reading disability and perceptual mode functioning, namely, the subjects used and the method of classifying perceptual mode preference. Both studies used groups of "normal" children, i.e., none had been identified as having a reading disability, and both used the ITPA to classify children as having a visual or auditory preference. This was done by considering the difference between visual and auditory scores. Since the difference between the mean auditory and mean visual scores for Bateman's group was nine months, she

designated an auditory score nine months or more above the visual as showing auditory preference and less than nine months difference as indication of a visual preference. Waugh's most stringent classification used a discrepancy of two SDs between auditory and visual scores to classify an auditory preference. In both cases, Ss could still have had scores for the non-preferred modality which fell near the mean.

Perhaps there is a minimum level of functioning for a given modality which enables the child to learn by that modality. Possibly, then, if he falls below that minimum level he may have difficulty. On the other hand, if his level of functioning rises above the minimum level it may not differentially affect his capacity to learn. For example, a child might score higher on auditory tests than on visual and so, by Bateman's or Waugh's classification he could be said to have an auditory preference. However, if his visual mode functioning, although lower than his auditory, was still above the minimum level, then presumably he could learn equally well by either mode.

The work of de Hirsch, Jansky and Langford (1966) can be interpreted as suggesting support for this position. Fifty-three Ss were studied at the end of kindergarten as part of the investigators' early efforts to develop a predictive index of reading failure. For the majority of the Ss there was no significant difference between the

auditory and visual modalities as measured by four auditory and four visual tests. For 10 Ss, however, a significantly discrepant pattern was seen. Seven Ss were high on the auditory and low on the visual mode. Three others showed the reverse pattern. These three, high visual, low auditory, all read successfully at the end of grade two. Presumably their initial instruction was a highly visual program. Of the seven who were high auditory, low visual, five passed and two failed all the reading tests at the end of grade two. Information given by the teachers of these children revealed that the five who passed had all received intensive instruction in phonics while the two who failed had been in more visually oriented programs and had not received phonics instruction. No details of the teaching methods were given so this evidence is admittedly anecdotal. It does, however, suggest that below some minimum level of functioning it may be difficult for a child to learn by that perceptual mode. It also suggests that instruction to the stronger mode can be successful.

There is a discrepancy between the implications of this study and the findings of Robinson (1972) that there was no effect of instruction to the stronger mode. Three possible reasons for the discrepancy might be considered. Robinson gave no data as to the level of success of the individuals in learning to read. It is possible that if the groups which were high on one modality and low on the other had been

studied from the point of view of success or failure in learning to read, individual cases in which modality of presentation facilitated or hindered learning may have appeared. It is also possible that Robinson, like Bateman, may not have identified truly auditory or visual learners. She took the median score on all tests as the dividing point for classifying Ss as low or high on a modality because normative data were not available for the tests used. It seems possible that some Ss, identified in this way as being low on a given modality, may still have been above the hypothesized minimum for being able to learn through that modality. These Ss may have obscured group differences in response to different methods. The third possibility applies to the study of Bateman as well as that of Robinson. Both used a design in which classes of children were taught to read by standard teaching approaches, with a Phonic or a Visual method. There is always the possibility in such a regular teaching situation that sensitive teachers may have adapted their methods to suit individual differences in the learner. By so confounding the methods in use, any differential effect may have been obscured.

Summary of findings from the literature. Nine studies considered the effects of remedial reading programs in schools or learning centres. Five of these studies used control groups and of these, four carried out follow-up studies. Four studies did not use control groups. One of

these was a five-year longitudinal study. Two of the other studies not using a control group took follow-up measures on the Ss. The findings from this group of nine studies may be summarized as follows:

1. The remedial groups all showed significant initial improvement.

2. By the time of follow-up, differences no longer existed between the remedial and the control groups.

3. With follow-up help, the remedial Ss held the gains made during remediation and continued to make some progress but without such help any further gains were minimal.

Possible reasons for these findings were suggested:

1. Individual attention and the reduction of pressure on children who have experienced repeated failure have been found to produce important positive effects on school performance.

2. In many cases the remedial methods used appeared to be only conventional instruction given on an individual or small group basis.

3. Improvement due to a change in the learning environment such as attention or reduced pressures, may have masked the fact that no specifically designed remedial help was given. Return to the previous environment may have resulted in decreased performances.

Special remedial techniques designed to use the learner's strongest perceptual modality have been discussed

earlier. Seven studies were reviewed which attempted to match the mode of instruction to the stronger perceptual mode of the Ss. Five of these studies used beginning readers or normal primary grade children as subjects. None of the five found evidence that matching mode of presentation to the stronger perceptual mode facilitated learning. Possible reasons for this finding were suggested:

1. A minimum level of functioning of a perceptual mode may make it possible for a S to learn by that mode, but functioning above this minimum level may not have a differential effect on the ability to learn by one or the other mode.

2. The method of classifying Ss into groups may have confounded Ss with the hypothesized requisite minimum level of functioning with those having a deficit in a particular mode.

Two studies using Ss with a reading disability found that instruction to the strong modality led to significant gains in learning.

Hypotheses

Reading is a complex process involving inference and generalization leading to the comprehension of the information and ideas contained in written material. However, in the early stages of learning to read, the basic skills of perceiving and decoding written symbols have still to be acquired. It is at the basic level of word recognition that the child with a reading disability often needs help. Conventional instruction, however, is not normally effective for children with reading disability (Eisenberg, 1966). Special remedial techniques, therefore, have been designed to present material through the learner's strongest perceptual modality. While a consideration of individual modality preference does not seem to make a difference to normal learners, there is some indication in the literature (Neville, 1971; Bursuk, 1971) that it may be an effective approach for children with reading disabilities.

Statement of the problem. To investigate the effectiveness of teaching word recognition according to the perceptual modality strengths of boys with specific reading disability.

Design. Classroom studies may have been hampered by uncontrolled variables such as inadvertent variation in teaching methods. Because of this the use of a more controlled experimental situation was planned for this study.

The teaching of word recognition is well suited to this more controlled approach.

Mills (1955) has said, "It should be understood that there is no pure method or approach to the teaching of word recognition. All words have visual, phonic and kinesthetic elements which cannot be divorced completely from each other. When we speak of the phonic method we simply mean that stress becomes the differential between the various methods [p. 21]."

Two methods of teaching word recognition emphasizing presentation to different perceptual modes were used in this study. The first method entailed visual, auditory and kinesthetic (vocal) input and stressed visual matching and visual memory. This was called the Visual Method.

The second method also involved visual, auditory and kinesthetic input but emphasized hearing the phonetic elements of the word and blending these elements to sound out the word. This was called the Auditory Method.

In assessing perceptual functioning it would seem to be important to use tests for which normative data are available in order to identify deficits in functioning. Various tests and batteries of tests have been suggested but those which combine several aspects of perceptual functioning may run the risk of confounding their effects. In addition, use of the criterion of agreement on all tests used to evaluate one modality so limits the number of Ss

admitted to any category that a vast subject pool is required before an experimental group of useful size can be selected. It was, therefore, decided to restrict the perceptual tests used in this study to one test for each mode.

Auditory and visual perceptual functioning have been analyzed by Wepman (1964) in terms of basic functions: (a) discrimination, (b) memory, and (c) patterning (sequential behaviour). Discrimination would seem to be the sine qua non for perceptual activity. One particular aspect of visual discrimination with which children with reading disability frequently experience difficulties is figure-ground discrimination (de Hirsch, 1952). In a study reported by Silver (1960), 92% of 150 children with reading disabilities demonstrated such difficulty. Similarly, auditory discrimination is considered to be a perceptual skill important in the acquisition of reading (Bannatyne, 1971; Bateman, 1965). In the same 1960 study, Silver also reported finding a statistically significant defect in the ability to perceive similarities and differences in the auditory configuration of words. It was therefore decided to restrict the test for each mode to a test of discrimination.

The tests selected for use in this study were: the Embedded Figures test (Spreeen & Benton, 1969) which gives a measure of visual figure-ground discrimination and the

Meikle Consonant Perception test (Meikle, 1970) which is a measure of auditory discrimination of consonants. These tests are used in the Neuropsychology Laboratory at the University of Victoria and norms are available for the local population. See Appendix A for a description of the tests and reliability data.

Three groups of subjects were formed. The Visual group consisted of Ss who were average on the visual test and showed a deficit on the auditory test. The Auditory group showed the reverse pattern, and were average on the auditory test and had a deficit on the visual. The third group consisted of Ss who were average on both tests.

In order to overcome the difficulties of equating groups of children for age, IQ, and educational level, a repeated measures design was used so that each S would serve as his own control. Both methods were used with all Ss and the results analyzed to determine whether the methods were differentially effective for Ss with different patterns of perceptual mode strengths and weaknesses.

The design, then, was a 3 (perceptual groups) x 2 (teaching methods) design with repeated measures on the methods factor (Winer, 1971, p. 578). There were four dependent variables: trials to criterion, time to criterion, words recalled, and words per minute.

Hypothesis. It was hypothesized that boys with a specific reading disability would perform better on a word

recognition task, that is, they would take fewer trials and less time to reach criterion and would recall more words, when the method of presentation emphasized the S's strong perceptual mode. Visual Ss would learn more effectively when taught by a visual method and Auditory Ss would learn more effectively when taught by an auditory method. It was hypothesized that method of presentation would have no differential effect for Ss who were average on both the perceptual tests.

Statement of the null hypotheses. 1. There will be no difference between groups on the Visual method.

2. There will be no difference between groups on the Auditory method.

3. There will be no difference between methods for each of the three groups.

Post hoc analysis. It was expected that some Ss in this population would not reach criterion on the learning trials. A chi-square analysis was therefore planned for those Ss to determine if there was a relationship between perceptual category, method of instruction, and achievement of criterion.

Method

Subjects. There were 30 boys (age 7 to 15) in the study. Of these, 21 were drawn from the population of Cedar Lodge School, Cobble Hill, B. C., a residential school for boys with learning disabilities, and the remainder from a group of boys referred for special remedial reading help within School District #65, Cowichan, B. C.

The Meikle Consonant Perception test and the Embedded Figures test were administered and on the basis of these tests three groups of Ss were formed. The Visual group consisted of Ss whose scores fell in the normal range ($-.5$ SD and over) on the Embedded Figures and in the deficit range (below $-.5$ SD) on the Consonant Perception. An Auditory group S was one whose score fell in the normal range on the Consonant Perception and in the deficit range on the Embedded Figures. A third group, consisting of Ss whose scores were in the normal range of both tests, was designated as the "Both" group. There were 10 Ss in each group. No Ss with conclusive evidence of brain damage were included in the study.

The Full Scale IQ score frequently has been used to determine whether ability lies within the normal range. However, children with specific reading disability often show a wide discrepancy between Verbal and Performance Scale scores on the WISC (Ingram & Reid, 1956; Kinsbourne & Warrington, 1966). Where this is the case, Clements and

Peters (1962) suggest that use of the Full Scale IQ score (which averages the Verbal and Performance scores) may be almost meaningless. Therefore, either the Verbal or the Performance Scale of the WISC was used to determine that the Ss in the study fell in the Dull Normal range or above (80 and above).

Analyses of variance on IQ for the three groups showed that there was a difference between them on Full Scale IQ ($p < .01$), Verbal IQ ($p < .05$) and Performance IQ ($p < .01$). See Tables I and II for a table of means and a summary table for the analyses of variance. Evaluation of the difference between the means using Scheffe's test (Edwards, 1967, p. 266) revealed that the mean IQ of the Visual group was significantly higher than the Both and the Auditory groups on the Full scale score (t 2.85, $p < .05$; t 3.15, $p < .05$), higher than the Both group on the Verbal scale (t 3.6, $p < .05$), and higher than the Auditory group on the Performance scale (t 3.33, $p < .05$). There were no significant differences between the Both group and the Auditory group on any of the IQ scales.

Differences between expected reading level and actual reading level as measured by a Wide Range Achievement Test (Jastak & Jastak, 1965) ranged from more than four years for some of the older Ss to six months for some in the primary grades (see Appendix B). A retardation of two years or more in the upper grades and one year in the primary grades is considered to be diagnostically significant by Bateman

TABLE I

The Mean and Standard Deviation for All Groups on the Full Scale, Verbal Scale and Performance Scale of the WISC

Group	Full Scale		Verbal Scale		Performance Scale	
	Mean	SD	Mean	SD	Mean	SD
Both	85.1	7.28	78.1	9.43	95.6	7.28
Auditory	83.7	11.53	86.1	11.83	83.9	13.74
Visual	98.5	11.91	95.2	10.53	102.6	14.9

TABLE II

Summary Table for the ANOVA on the Full Scale,
Verbal Scale and Performance Scale of the WISC

	Source	<u>SS</u>	<u>df</u>	<u>MS</u>	<u>F</u>	<u>p</u>
Full Scale	Between	1335.2	2	667.6	6.10	<.01
	Error (within)	2955.5	27	109.46		
Verbal Scale	Between	1464.07	2	732.03	6.47	<.01
	Error (within)	3055.4	27	113.16		
Performance Scale	Between	1785.27	2	892.63	5.77	<.01
	Error (within)	4175.7	27	154.65		

(1965) and Boder (1971), while three to six months in grades one and two is considered significant by Kaluger and Kolson (1969). The following criteria for defining reading retardation were accepted for this study: six months retardation in grade one, a retardation of one year or more in grades two and three, and a retardation of two years or more in grade four and above.

An analysis of variance on the age of the three groups revealed that there was a significant difference in the age of the groups (see Tables III and IV). Scheffé's test of the difference between the means revealed that the Visual group was significantly younger than the Both group ($t = 3.3$, $p < .05$).

Remedial methods. The two teaching methods used were adaptations of existing methods to the experimental situation. The Visual method was similar to the look-and-say approach (Scott Foresman series, 1968). The Auditory method was similar to many phonics approaches to reading, such as that of Gillingham (1965). Auditory methods teach letter-sound correspondences on a systematic basis over an extended period of time. In the experimental situation the letter-sound associations were taught within the context of each word.

Tasks. Each S was individually taught two lists of eight words each. List 1 was taught on two consecutive days (Day 1 and Day 2). List 2 was taught on two consecutive

TABLE III

The Mean and Standard Deviation on Age for All Groups

Group	Age	SD
Both	12.5	2.06
Auditory	11.7	1.25
Visual	9.4	2.71

TABLE IV

Summary Table for the ANOVA on Age

Source	<u>SS</u>	<u>df</u>	<u>MS</u>	<u>F</u>	<u>p</u>
Between	51.8	2	25.9	5.88	.01
Error (within)	119.	27	4.40		

days one week later. One list was presented by the Visual method, the other by the Auditory. On both Day 1 and Day 2, lists were presented to a criterion of one errorless reading through the list or until 20 minutes had elapsed.

Instructors. Two instructors were used with the Cedar Lodge Ss, Experimenter (E) and a teaching assistant on the school staff. Each instructor taught one-half of each perceptual group. Each S had the same instructor for both methods. The public school Ss were taught by E.

Measures. (a) Trials to criterion provided a measure of learning process and was the total number of trials required to reach criterion on Days 1 and 2. A trial was defined as one teaching presentation of the list (see Appendix C). (b) Time to criterion, too, was a measure of learning process and was the total time required for Days 1 and 2. (c) One-week recall provided a measure of learning outcome. One week after Day 2 the word cards were shuffled and presented to the S one at a time. If the word was correctly identified (read) within two seconds it was scored as correct. The total number of correctly identified words was the one-week recall measure. (d) Words per minute. It seemed possible that a method might result in superior recall for some Ss but require more time for learning to take place. It seemed that useful information might be derived by combining the Recall and Time measures to yield a single measure of what might be termed method efficiency.

A ratio of one-week recall to time to criterion was calculated to give a words per minute score.

Word lists. Individual lists were determined for each S by drawing randomly from word pools at the S's word recognition level as determined by the Wide Range Achievement Test (Jastak & Jastak, 1965). Words were selected from Mill's Learning Methods Test (1955) and The Teacher's Word Book of 30,000 Words (Thorndike & Lorge, 1959). Separate pools of phonetically spelled and non-phonetically spelled words were established. These pools were subdivided according to word length (e.g., there was a pool of phonetic 5-letter words and a pool of non-phonetic 5-letter words). Each list was made up of an equal number of phonetic and non-phonetic words. Word lists were balanced across methods for word-length (e.g., the same number of 4-letter and 5-letter words). (See Appendix D.) Each stimulus word was printed on a 3 x 5 inch card in half-inch letters.

Procedure. Half of each group was taught by the Visual method first, and half was taught first by the Auditory method. Before beginning the first teaching session for each method, all words to be taught by that method were presented to the S one at a time and he was asked to read them. If a word was found that he could already read, it was discarded and the first word that he could not read from the appropriate pool was substituted. The list was then

taught following the detailed steps outlined in Appendix C. The following day the eight stimulus word cards were shuffled and presented one at a time. If the S did not identify the word correctly within two seconds, it was set aside for re-learning. The number of correct responses was recorded. Re-learning trials were conducted and recorded in the same manner as the original learning trials.

One week later the stimulus word cards were shuffled and presented to the S one at a time. The number of correct responses was recorded. Immediately following the one week recall measure the second list was presented for the first time. The same procedure was followed as for List 1.

Results

A repeated measures analysis using the ANOVA 88 program (University of Victoria Computing Services) was carried out for each of the four dependent variables. The .05 level of probability was set as the criterion for determining the significance of results.

Trials to criterion. Five Ss did not reach criterion in the time allotted for the Visual method and eight did not reach criterion by the Auditory method. For purposes of the analysis, an arbitrary score of 10 was assigned to these Ss. This choice was based on the fact that for those Ss reaching criterion, the number of trials ranged from 1 to 6. For this analysis the Method effect was found to be significant at the .0007 level. There was a significant difference between the two methods when considered over all groups. Fewer trials were required to reach criterion by the Visual method. There was no difference between groups on this measure and no Method x Group interaction was found. The summary of results is presented in Table V.

Time to criterion. For this analysis the Method effect was found to be significant at the .0003 level. There was a significant difference between methods when considered over all groups. Less time was required to reach criterion by the Visual method. There was no difference between groups and no Method x Group interaction was found. The summary of results is shown in Table VI.

TABLE V

Repeated Measures ANOVA on Trials to Criterion for
Three Perceptual Groups Exposed to Two Teaching Methods

Source	<u>SS</u>	<u>df</u>	<u>MS</u>	<u>F</u>	<u>p</u>
Subjects	2219.15	29			
Percept. Groups	195.30	2	97.65	1.30	.288
Error	2023.85	27	74.96		.
Method	126.15	1	126.15	14.58	.0007
Method x Group	24.70	2	12.35	1.43	.257
Error	233.65	27	8.65		
Total	384.5	30			

TABLE VI

Repeated Measures ANOVA on Time to Criterion for
Three Perceptual Groups Exposed to Two Teaching Methods

Source	<u>SS</u>	<u>df</u>	<u>MS</u>	<u>F</u>	<u>p</u>
Subjects	4360.4	29			
Percept. Group	129.7	2	64.85	0.41	.665
Error	4230.7	27	156.69		
Method	552.07	1	552.07	16.91	.0003
Method x Group	106.23	2	53.12	1.62	.217
Error	887.7	27	32.88		
Total	1546.00	30			

Recall. The analysis on this measure showed that there was no significant difference between groups and no Method x Group interaction. The difference between methods on this measure was not statistically significant ($p = .058$). Table VII reports the summary of results.

Words per minute. For this analysis the Method effect was significant at the .002 level. More words per minute were learned by the Visual method. No difference between groups was found and no Method x Group interaction was demonstrated. The summary of results is reported in Table VIII.

A graphic representation of means for each group on the four measures is shown in Figures 1 to 4.

Hypotheses 1 and 2 were not rejected. Hypothesis 3 was rejected on the basis of the analysis of Trials, Time to Criterion and Words per Minute, but was not rejected by the analysis of the Recall measure.

Post hoc analysis. It had been anticipated that some Ss would not reach criterion and this expectation was borne out. There were five Ss who did not reach criterion by either method. An additional three Ss who reached criterion by the Visual method did not reach criterion by the Auditory method. Table IX shows the breakdown by perceptual groups for these Ss.

A chi-square analysis was carried out for each method to test the hypothesis that reaching criterion was unrelated

TABLE VII

Repeated Measures ANOVA on Recall for
Three Perceptual Groups Exposed to Two Teaching Methods

Source	<u>SS</u>	<u>df</u>	<u>MS</u>	<u>F</u>	<u>p</u>
Subjects	219.68	29			
Percept. Group	11.43	2	5.72	0.74	.49
Error	208.25	27	7.71		
Method	6.02	1	6.02	3.92	.058
Method x Group	3.03	2	1.52	0.99	.385
Error	41.45	27	1.54		
Total	1960.82	30			

TABLE VIII

Repeated Measures ANOVA on Words per Minute Learned for
Three Perceptual Groups Exposed to Two Teaching Methods

Source	<u>SS</u>	<u>df</u>	<u>MS</u>	<u>F</u>	<u>p</u>
Subjects	2.41	29			
Percept. Group	0.12	2	0.06	.73	.491
Error	2.29	27	0.08	11.77	.002
Method	0.35	1	0.35	1.84	.178
Method x Group	0.11	2	0.05		
Error	0.80	27	0.03		
Total	1.25	30			

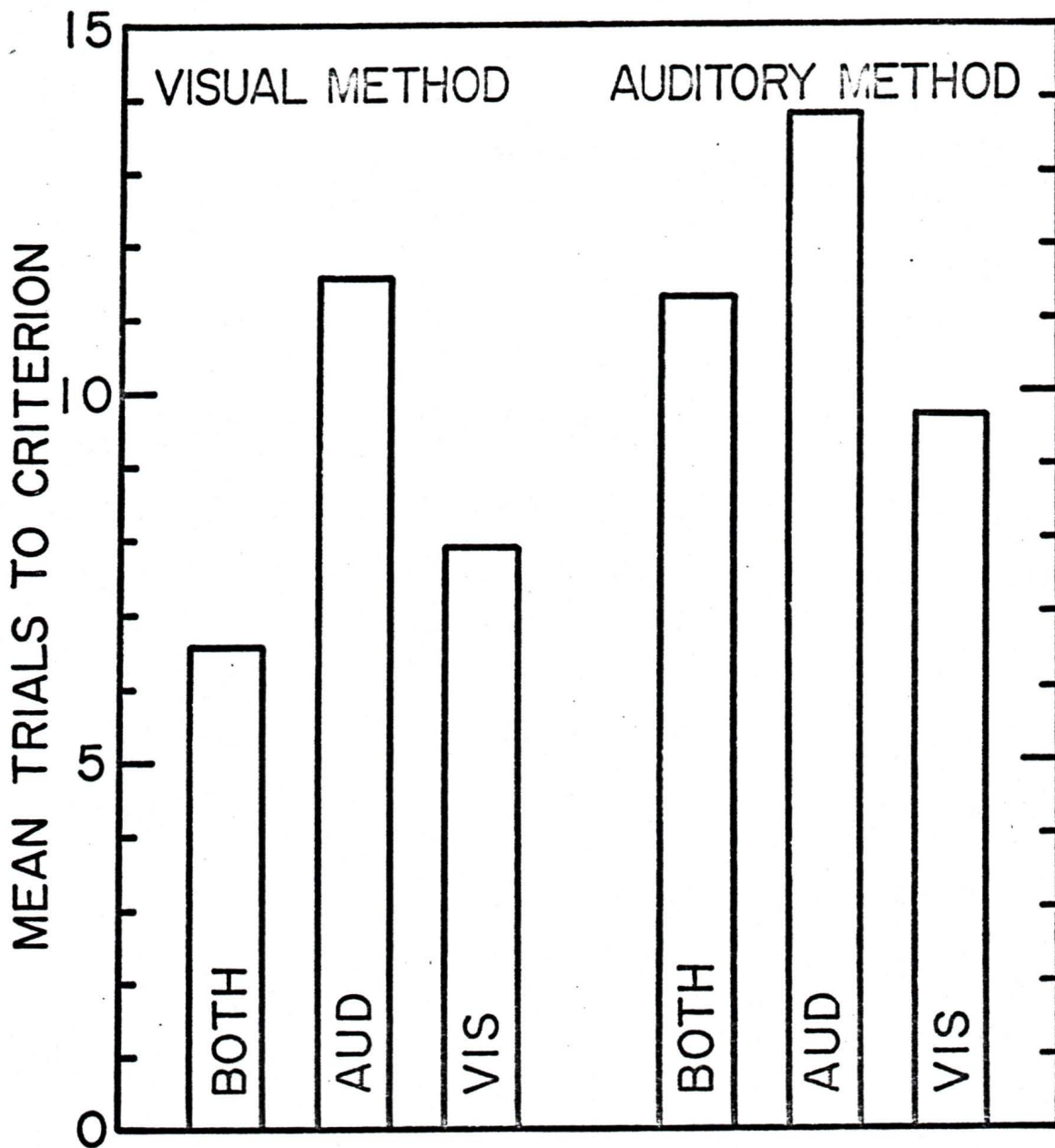


Figure 1 Trials to criterion for Ss grouped on the basis of two perceptual tests and taught by two methods.

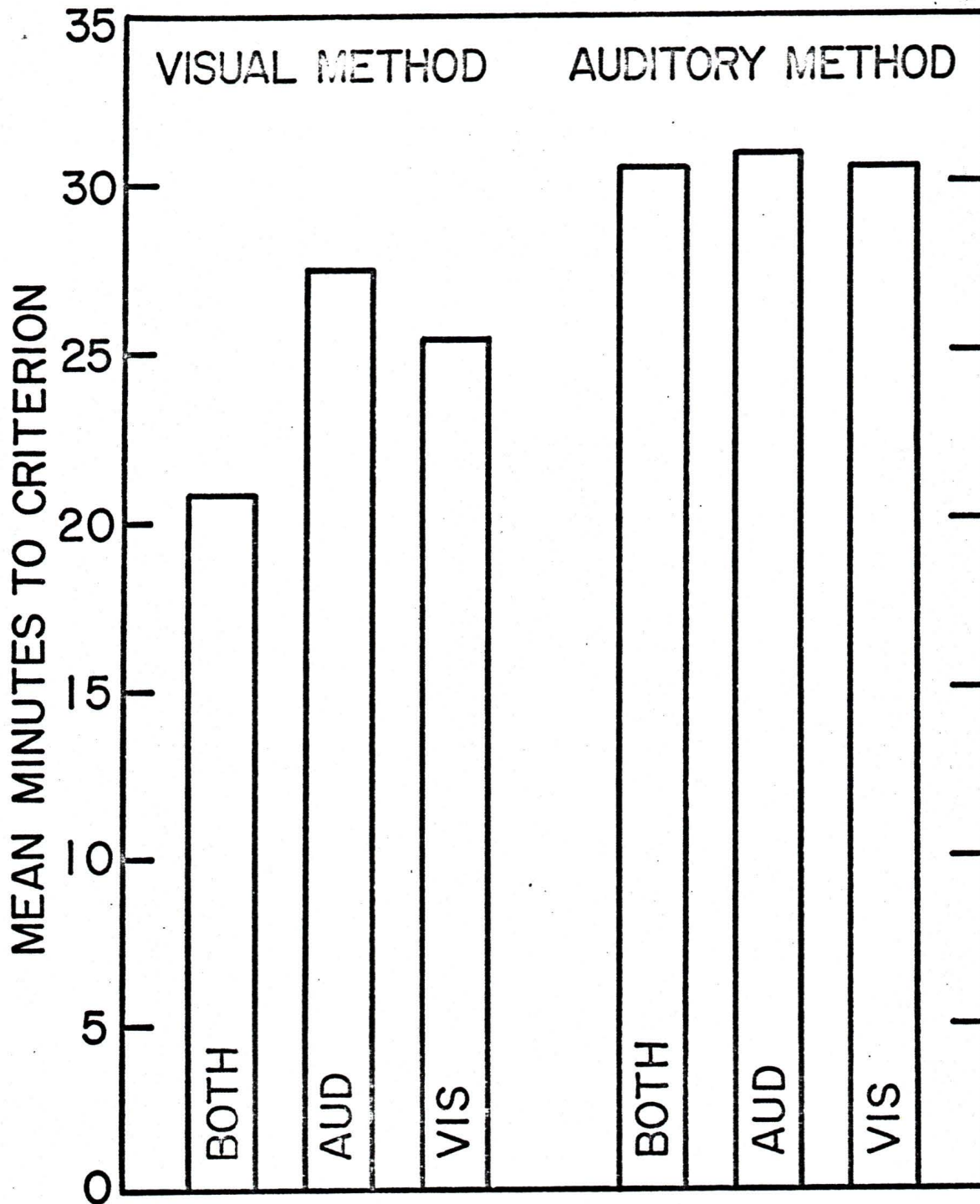


Figure 2 Time to criterion for Ss grouped on the basis of two perceptual tests and taught by two methods.

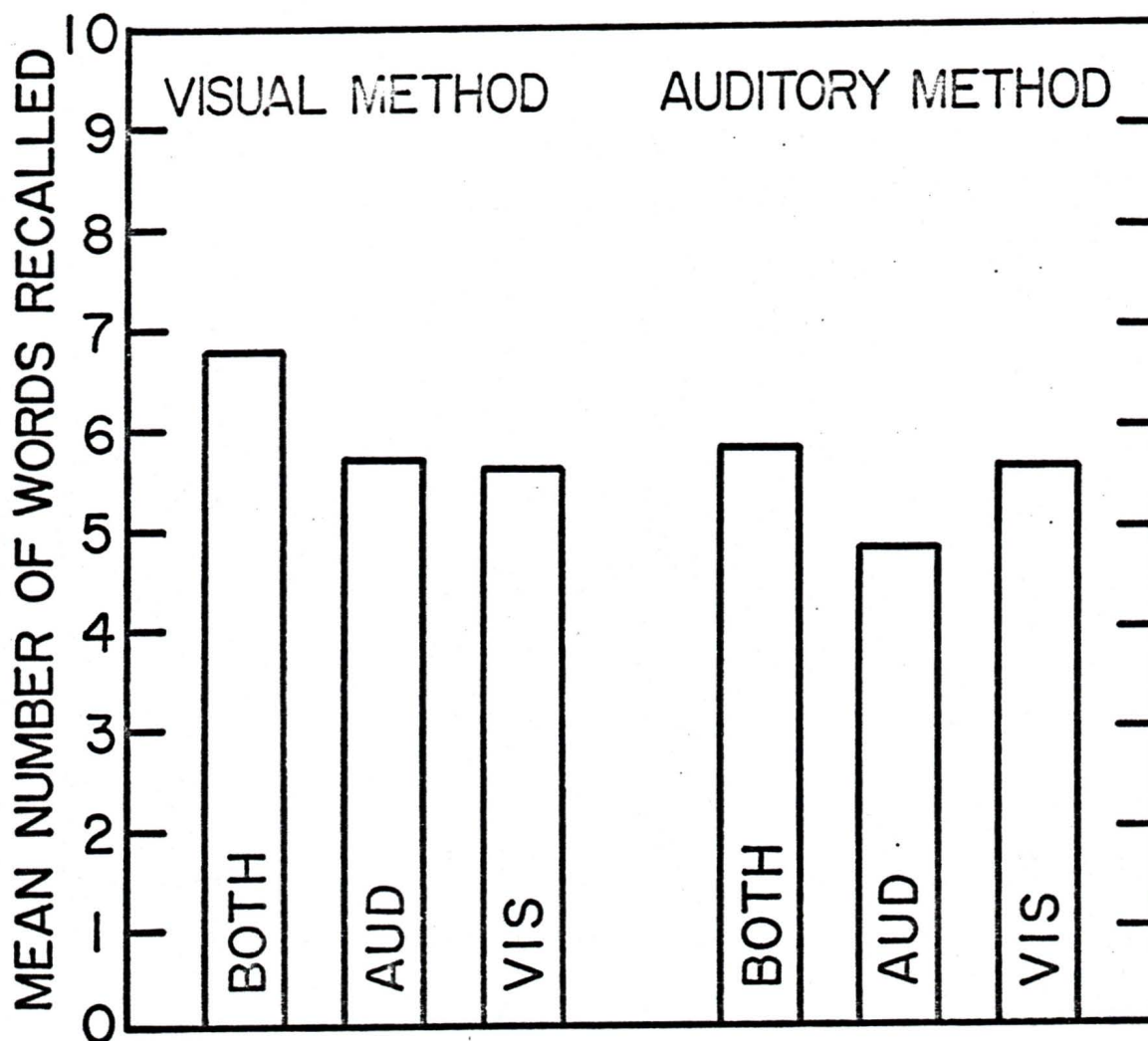


Figure 3 Recall for Ss grouped on the basis of two perceptual tests and taught by two methods.

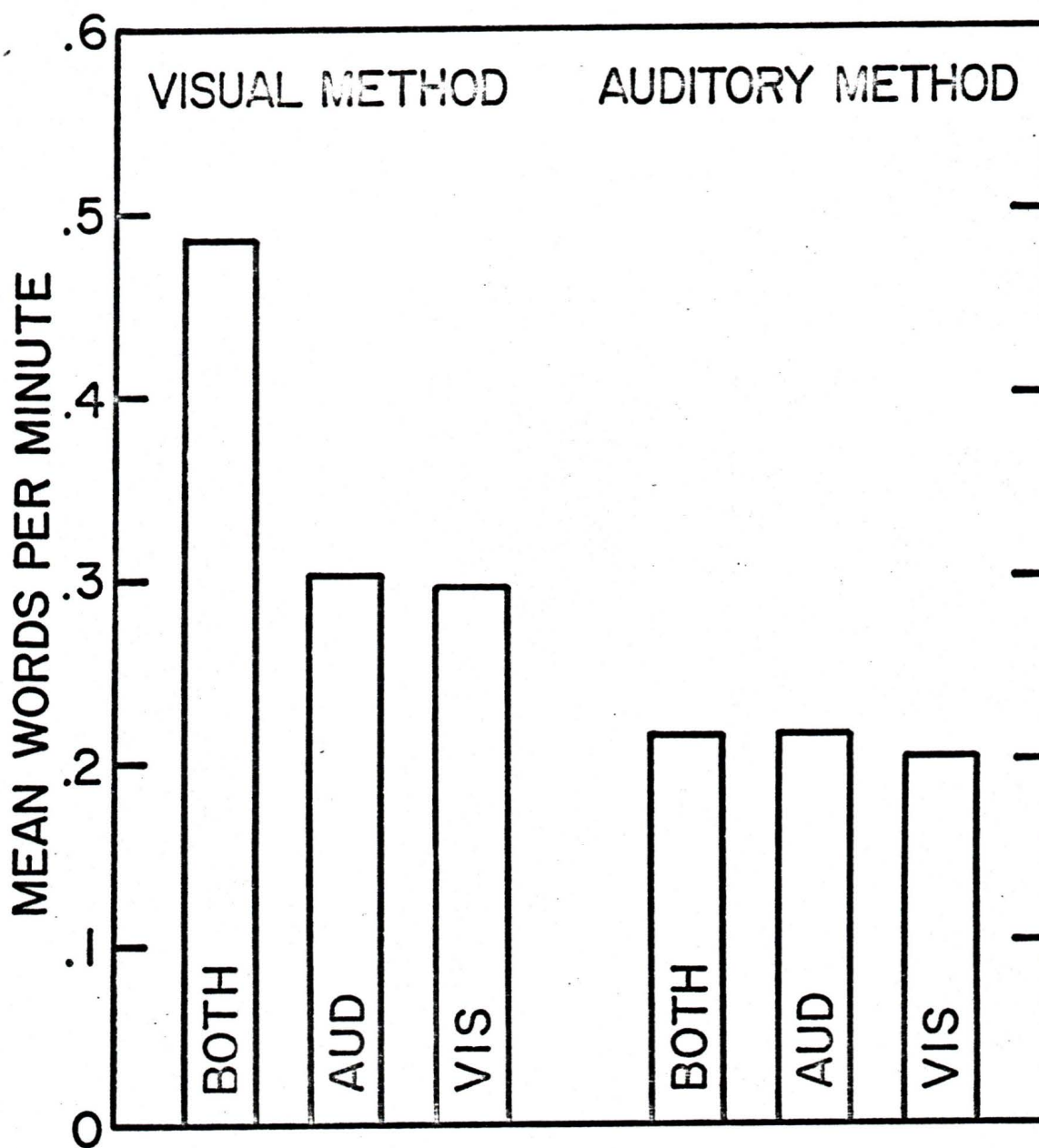


Figure 4 Words per minute for Ss grouped on the basis of two perceptual tests and taught by two methods.

TABLE IX

Subjects Who Did Not Reach Criterion Shown by
Perceptual Group and Method of Instruction

Group	Method	
	Visual	Auditory
Both	1	1
Auditory	3	4
Visual	1	3

to perceptual category. The null hypothesis was not rejected with $\chi^2 = 1.93$, df 2, p > .05 and $\chi^2 = 2.39$, df 2, p > .05 for the Visual and Auditory methods respectively. For both methods a similar proportion of Ss in each perceptual group did not reach criterion.

A chi-square analysis was carried out to test the hypothesis that reaching criterion was unrelated to teaching method. Because there was one degree of freedom in the analysis, a correction for discontinuity was applied as suggested by Edwards (1967, p. 333). This hypothesis was not rejected with $\chi^2 = .3926$, df 1, p > .05. A similar proportion of Ss did not reach criterion by either method.

Discussion

The purpose of this research was to attempt to ascertain whether, for boys with a specific reading disability, a word recognition task would be facilitated if the words to be learned were presented by a method which placed emphasis on the S's stronger perceptual modality. A visual and an auditory perceptual test were used, for the classification of Ss into three perceptual groups. One group was average on both tests, one group was average on the visual test only, and one group was average on the auditory test only. When these groups were compared on the basis of Trials, Time, Recall, and Words per Minute it appeared that in this experimental situation it made no difference to the learning of the word recognition task whether the method emphasized the use of the average or the weak perceptual modality. What appeared most clearly on the basis of three of the measures was a strong difference in favour of the Visual method. (When the Recall measure was analyzed this method difference did not quite reach statistical significance.) The hypothesized interaction effect of the Visual method being more effective for the Visual group and the Auditory method more effective for the Auditory group, did not appear.

At first glance these findings seem to agree with the research investigating beginning readers. Bateman (1968), Harris (1965) and Robinson (1972) all found no facilitation

of learning due to matching of perceptual mode preference to method. These situations were not directly equivalent to the present one since they were evaluating a regular teaching process over a considerable period of time. However, both Bruininks (1968) and Waugh (1973) used an experimental setting comparable to the present research to investigate the teaching of word recognition and they, too, found that beginning readers learned equally well when taught to their strengths or their weaknesses. Yet Neville (1971) and Bursuk (1971), both working with disabled readers, found evidence for enhanced learning when the method was matched to perceptual strengths. Before accepting the conclusion that this present research supports the premise that boys with specific reading disability learn equally well if taught to strengths or weaknesses, alternative explanations for the findings were sought.

Group homogeneity. Consideration was given to the possibility that the groups were systematically different in other respects than response to the perceptual tests. They were not, for example, homogeneous for age and IQ. Examination of Figure 3 shows that although the differences are not statistically significant, the group that was average on both tests tended to perform better than the Ss who were below average on one modality. (This is in agreement with the finding of Robinson [1972] that children who scored high on both modalities achieved higher reading

scores at the end of grades one and three than those low on one modality.) Both the Auditory group and the Both group recalled proportionally more words when taught by the Visual method than by the Auditory. The performance of the Visual group, no different in Recall on the two methods, was contrary to expectations and contrary to the pattern exhibited by the other two groups. In order to understand the pattern of group performances on the Recall measure an attempt was made to clarify the relationship between both IQ and age and the tasks being performed.

To establish whether a relationship existed between IQ and performance on the research tasks, Pearson product-moment correlation coefficients were calculated between Full Scale IQ and Recall, Trials to Criterion, and Time (see Table X). There was no significant correlation between IQ and the recall measure over all groups. There was a significant negative correlation between IQ and the number of trials required to reach criterion by both the Visual and Auditory methods. A significant negative correlation also existed between IQ and the time taken to reach criterion by the Auditory method. These correlations, although significant, were so low as to account for only 10% to 20% of the variance. Although they do seem to indicate the possibility of a differential response to methods when groups differ on IQ, these findings suggest that the IQ differences had little effect on the results.

TABLE X

Pearson Product-Moment Correlations Between
Full Scale IQ and Three Measures

	Visual Method	Auditory Method
Recall	.10	.30
Trials	-.32*	-.45*
Time	-.15	-.35*

* $p < .05$

Correlation coefficients calculated for age and the research measures revealed no correlation between Recall or Trials and age (see Table XI). The amount of time taken to reach criterion by the Visual method was significantly negatively correlated with age, although the correlation would only account for approximately 10% of the variance.

As a result of these analyses, it was felt that the three groups were not homogeneous for age and IQ and that these variables might be related to some of the groups' responses to the two methods. The differences between the groups appeared to be for the most part accounted for by the Visual group. The Both and the Auditory groups were homogeneous on both the age and IQ variables. Therefore, a post hoc comparison was carried out to test the difference between the means of the Both and the Auditory groups on the Recall, Trials, and Time measures. In accordance with the hypothesis being tested in this study, it was predicted that on the Visual method the Both group, being average on the Visual test, would perform better than the Auditory group which showed a deficit on the Visual test. Therefore, a one-tailed test was used. For the means on the Auditory method it was predicted that there would be no difference between the two groups since they were both average on the Auditory test.

A significant difference was seen only on the Trials to

TABLE XI

Pearson Product-Moment Correlations Between
Age and Three Measures

	Visual Method	Auditory Method
Recall	.32	.07
Time	-.37*	-.02
Trials	-.23	-.03

* $p < .05$

Criterion measure (t 1.745, df 18, p < .05). The Both group took significantly fewer trials to reach criterion by the Visual method. This was the predicted result. At the same time there was no significant difference in the number of trials taken by the two groups when taught by the Auditory method. This, too, was expected. It appears, then, that when groups homogeneous for age and IQ are considered, there may be some limited support shown for the hypothesis that matching method to perceptual strength will facilitate learning.

An attempt was made to clarify the relationship between group differences on IQ and group responses on the word recognition task. Ss who were as closely matched for IQ as possible were selected from the three perceptual groups and their performances on the tasks were compared. Appendix E contains the details of this post hoc analysis.

It was seen that creating groups homogeneous for performance IQ raised the overall level of performance relative to the original non-homogeneous groups. The pattern of group responses remained unchanged, however, from that of the original group and the performance of the Visual group on the Recall measure was still contrary to the pattern exhibited by the other two groups.

The question should be considered as to whether the higher mean IQ and the lower mean age of the Visual group are in any way related to the functioning of the groups on

the perceptual tests or artifacts of the subject-gathering procedure. Originally it was planned to use only the subject population in the residential school for boys with learning disabilities. At the conclusion of testing, however, it became apparent that Ss were lacking in the Visual group. Out of a tested population of 40 severely reading disabled boys only two (5%) met the criterion (average on the Visual test, below average on the Auditory) for inclusion in this group. The subject pool was then enlarged to include boys referred for remedial reading in the public school system. Here eight Ss were found in a tested population of 37 (approximately 22%). One possible explanation for this discrepancy might be that these Ss, possessing on the average higher IQs than those in residential treatment were able to compensate for their deficit in the Auditory area and so remained functional in the regular system with special help. This, of course, only gives a partial reason for these particular Ss not to be in residential treatment. It does not explain why there are not more Ss with the same deficit on the Auditory test and with a lower IQ in the residential group. Since the average age of the boys in the Visual group was lower than that of the Cedar Lodge Ss perhaps it is possible that this deficit is one which tends to disappear with maturation. If this were so it was felt that perhaps some of the Cedar Lodge Ss had belonged in this category at an earlier date but now no

longer showed this deficit. An examination of previous years' test results for the Cedar Lodge Ss tends to discount the developmental explanation. The reliability study carried out at the beginning of this research showed a high level of reliability for the two tests over a 3-week period (r .826 for Embedded Figures, r .785 for the Meikle Consonant Perception test).

Test results for these two tests were available in the school records for the Cedar Lodge Ss over a longer interval ranging from about six months to two years. The reliability figures over this longer interval were .621 for the Embedded Figures and .520 for the Meikle. Although these coefficients are statistically significant beyond the .005 and .01 levels respectively, when individual cases were compared it was found, not surprisingly, that some Ss had changed considerably over the longer time interval.

At the time of the present research 10 Ss were classified as average on both tests. On the basis of the earlier scores from the Cedar Lodge records, three of this group would have been classified as having a deficit on one of the perceptual tests. Only one of these three had previously been low on the Auditory test, i.e., a Visual group S "grown out of" this classification. Only two Cedar Lodge students were presently in this category. These two Ss were older than the rest of the Visual group (13 and 14 respectively when the group average age was 9.4). These two

facts do not seem compatible with maturation as an explanation for the low incidence of Visual group Ss in the Cedar Lodge population. It is interesting to note that Smith (1971) has suggested that the incidence of visual or auditory Ss in a normal population may vary with IQ and/or socioeconomic level.

Generally speaking, in this research sample, those Ss who were low on the Consonant Perception test but average on the Embedded Figures (the Visual group) seem to be less severely handicapped for learning to read than those with the reverse pattern. At least fewer of this group are seen to be in the residential treatment centre of this area at the present time. Whether this possibly may mean that whatever causes the reverse pattern in the Auditory group also creates more widespread dysfunction, e.g., spatial or cognitive disturbances, is purely speculative. Future research on this question could begin with an investigation of correlated dysfunctions.

Inspection of the changes over time for all the Cedar Lodge Ss showed that for 13 of the 20 Ss the rating on the two tests had changed enough that they would have been placed in different perceptual groups if classified at the earlier date. Of these, 11 had improved over time. The two Ss who did not improve had been in the Both category earlier

and now one showed low on the Visual test and the other was low on the Auditory.

Koppitz (1971) reported that often in the remedial setting she found that children were not showing new learning but rather earlier learning which they had previously been unable to demonstrate. This raises the question as to what effect previous deficiency may have had on the Ss' responses to the experimental methods in this study. The Ss were reclassified according to the earlier perceptual test results (from six months to two years earlier). Four groups instead of three emerged. A group was found which had been low on both tests at the time of the earlier testing. This group was called the Both Low group. For purposes of the analysis the Visual group, which contained only one S, was dropped and an analysis of variance was carried out on the Trials and Recall measures for the Both Average group, the Auditory, and the Both Low groups containing 5, 8, and 6 Ss respectively. The ANOVA on the Recall and the Trials measures showed no significant group differences. (See Tables XII and XIII for summary tables of the analyses.) The means of the groups on these two measures are shown in Figures 5 and 6. It can be seen that the group which was low on both tests at the earlier time of testing, although now functioning at a higher level on at least one of the perceptual tests, was still responding to the word recognition task at a much

TABLE XII

ANOVA on Trials for the Cedar Lodge Ss Regrouped
on the Basis of Earlier Perceptual Testing

	Source	<u>SS</u>	<u>df</u>	<u>MS</u>	<u>F</u>	<u>p</u>
Visual Method	Between	145.03	2	72.51	1.71	>.05
	Error (within)	677.5	16	42.43		
Auditory Method	Between	6.42	2	3.12	.09	>.05
	Error (within)	564.71	16	35.29		

TABLE XIII

ANOVA on Recall for the Cedar Lodge Ss Regrouped
on the Basis of Earlier Perceptual Testing

	Source	<u>SS</u>	<u>df</u>	<u>MS</u>	<u>F</u>	<u>p</u>
Visual Method	Between	12.45	2	6.23	1.99	>.05
	Error (within)	50.07	16	3.13		
Auditory Method	Between	25.09	2	12.54	2.16	>.05
	Error (within)	92.7	16	5.79		

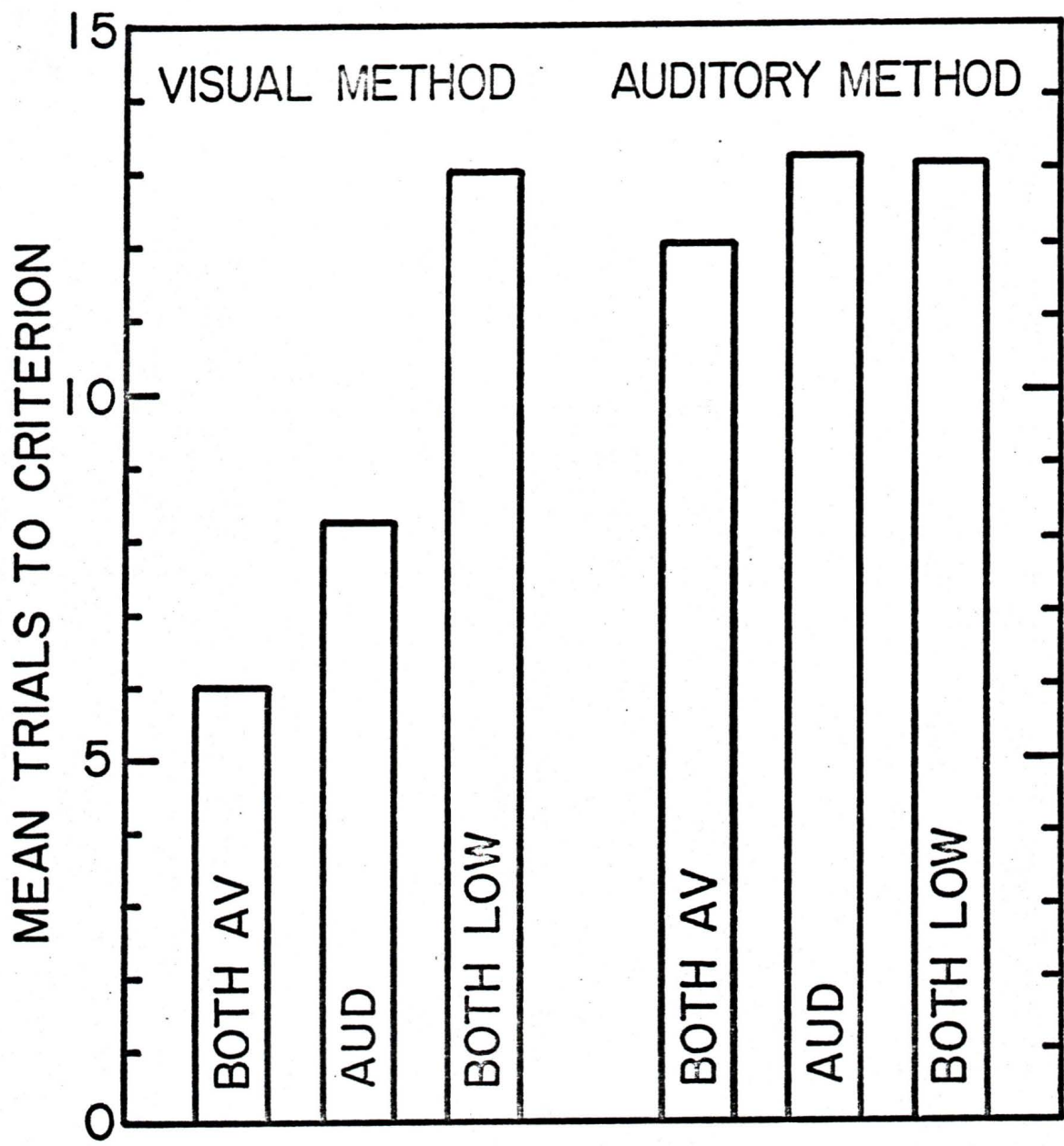


Figure 5 Trials to criterion for Cedar Lodge Ss grouped on the basis of earlier perceptual test results, taught by two methods.

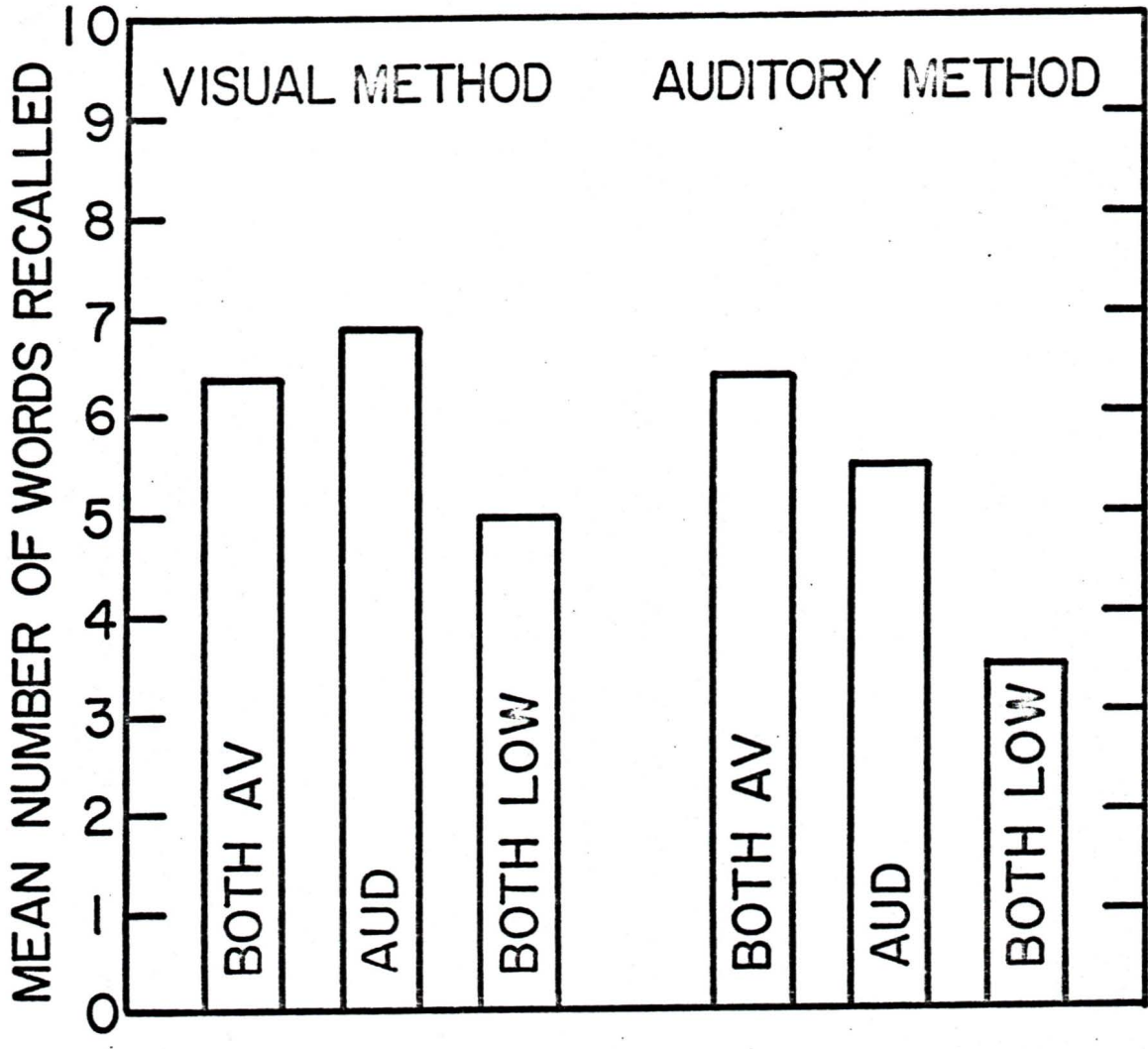


Figure 6 Recall for Cedar Lodge Ss grouped on the basis of earlier perceptual test results, taught by two methods.

lower level. This may indicate that the Ss were not demonstrating present response to the two methods but may have been showing the extent of a previously learned ability to use them. The experimental exposure to each method was limited to at most two 20-minute periods. It is possible that for these Ss a longer exposure to the teaching method may have been necessary for differential effects to show. This may be the reason that both Neville (1971) and Bursuk (1971) found a definite Method x Category interaction for children with reading disability while this study did not. They both used an extended period of classroom teaching (one semester in the case of Bursuk) for the evaluation of methods.

The usual experimental practice is to group the Ss according to some criterion and then institute the experimental treatment as soon as possible. The present findings might indicate that in certain cases such as the evaluation of the relationship of performance on perceptual tests to performance on a task it might be advantageous to have a planned period of delay between the two processes.

Method differences. Consideration was given to the possibility that there were systematic differences between the two methods other than the selective emphasis on perceptual mode. Two instructors were used for the Both and the Auditory groups and for two Ss of the Visual group (all the Cedar Lodge Ss). Only one was used for the remainder of

the Visual group Ss. It is possible that there were differences between these two instructors whose influence on learning may have shown up only when the counterbalancing effect was not present. To test for the differential effect of the two instructors, the differences between the two methods on both the Recall and the Trials measures were compared when the Cedar Lodge Ss were grouped according to instructor. No significant differences were found for either measure, t 1.002, df 19 and t 1.334, df 19, respectively. It was therefore concluded that there was no difference between the two instructors in their application of the methods and that the use of only one of them with the Visual group was not related to the Visual group differences.

Waugh (1973), in his study of normal second grade readers, found no Method x Perceptual group interaction. He felt that the lack of difference in recall between methods when considered over all groups was an indication that there was no difference in the difficulty of the two methods. This research, too, by considering only the recall measure, could have reached the same conclusion. However, measures of process, Trials to Criterion and Time to Criterion, were also collected in addition to the measure of learning. Although there was still no significant Method x Group interaction when these other measures were taken into account, it did become obvious that significantly more time was needed to reach criterion, and significantly more trials

were required by the Auditory method. Close examination of the physical manipulation of materials required by the methods indicates that possible differences between the two could exist on this level. The Visual method required the teacher to shuffle and place the cards in front of the S who then selected the correct match. The Auditory method, on the other hand, required the S to sound and arrange letters in the correct order to build the word. In the case of physically slow or awkward Ss, this could have led to a difference in the length of trials between methods. The Auditory method might have required more time to reach criterion due simply to the differences in physical handling of the materials which could make each Auditory trial longer than a Visual trial. However, since the Ss also took more trials to reach criterion by the Auditory method it seems that more than just the physical differences were affecting the time element.

Five Ss did not reach criterion in the allotted time by either method. It was seen that if a S did not reach criterion by the Visual method then he did not reach it by the Auditory method either, whereas three Ss who did reach criterion by the Visual method did not by the Auditory method. (See Table IX.) The chi-square analysis carried out on those Ss not reaching criterion was previously reported. It was found that not reaching criterion was statistically unrelated to either perceptual group or method.

This seemed to suggest that the Auditory method, requiring more of the longer trials and allowing fewer Ss to reach criterion regardless of group, may have been intrinsically more difficult than the Visual, but that there may be additional variables, unrelated to method or group, which influenced whether or not Ss actually reached criterion.

The possibility was considered that lack of previous experience with the phonetic approach may have tended to make the Auditory method more difficult for these Ss since the sound-symbol associations were taught incidentally within the context of each word. To clarify this point, information was gathered from teachers and taken from school records, where these were available, as to the methods of instruction being used with the Ss in the current school year. Such information was available for all but three of the Ss in the study. All but two of the Ss appeared to be receiving at least some systematic phonics training. The two not receiving phonics instruction were in the Both group, both reached criterion by both methods, took the same number of trials by both methods, one recalled the same number of words by both methods and the other recalled two more by the Auditory method. For the others, the reports indicated that the exposure to phonics ranged from twice weekly remedial lessons emphasizing word families, etc., to the use of a formal phonic approach to reading. Two-thirds of the Ss in the study were using readers from the Sullivan series (1968)

based on a phonics method, and also emphasizing acquisition of additional sight vocabulary. In addition, one-third were also using phonics workbooks. Although anecdotal in nature, this information does make it seem unlikely that unfamiliarity with a phonetic approach unduly exaggerated the difficulty of the Auditory method for the majority of the Ss. It does appear that a discrepancy in the difficulty of the two methods may have masked the effect of perceptual group interaction with method.

Measures. Consideration was given to the adequacy of the measures taken for revealing differences between the methods. Four measures were collected; (a) Trials to Criterion, (b) Time to Criterion, (c) Words Recalled, and (d) Words per Minute.

It was seen earlier that no significant correlation was found between Full Scale IQ and the number of words recalled. This seems surprising in view of the nearly universal finding in educational research of a relationship between IQ and measures of learning, e.g., Mills (1956). An examination of the raw scores revealed a possible reason for this lack of correlation between IQ and number of words recalled. Although the range of recall scores was from 0 to 8 and the mean for the Visual method was 6.8 words recalled and for the Auditory method was 5.8, it was found that one-third of the Ss scored 7 and/or 8 by both methods. The distributions were negatively skewed and it seems that a

ceiling effect may have prevented any possible correlation with IQ from showing.

The range of differences between recall by the Visual and the Auditory method for individual Ss was very limited, from +4 to -2. Taken by itself, this limited range might indicate that Ss learned equally well by either method. Taken in conjunction with the apparent ceiling effect for the Recall scores it seems more likely that the task was too easy for genuine differences to show if they did exist. A longer word list would render the task more difficult. The importance of a pilot study with the actual Ss to be used must be emphasized here. It is difficult when working with children who have a reading disability to find a level of task difficulty that will yield a normal distribution of results. To establish such a level is important if true patterns are to emerge.

The time measure, as we have seen, could have been artificially influenced by physical differences in the manipulation of stimulus materials between the two methods. If, however, steps were taken to control for these differences in future research, e.g., introducing S manipulation of stimulus cards in the Visual method, equivalent to the S manipulation of letters cards in the Auditory method, a useful measure of method-related time differences could result.

Since, in this project, both recall and time measures

had possible limitations, the words per minute measure based on them must share these limitations. However, given a more difficult task and with the manipulation of materials controlled it seems that the words per minute measure could usefully combine the learning outcome measure and the learning process measure into one measure revealing method efficiency.

In this study the trials to criterion measure seemed to be the most useful. The range, from 1 to 20, appeared to be normally distributed. The range of differences in trials required between methods was from +2 to -12. The post hoc analysis of this measure tentatively suggested that differences in learning rate may occur when the method is matched to strength or weakness on the two perceptual tests.

The usefulness of a process measure in addition to merely collecting a measure of learning outcome is illustrated by a consideration of the study reported by Waugh (1973). He felt that the auditory and visual tasks in his experiment were equally difficult. Waugh based this statement on the fact that overall means for the two methods were not different. The Visual mean was 9.05, SD 1.48; the Auditory mean was 9.14, SD 1.34. Since the word lists used in Waugh's study were 10 words long, it becomes apparent that a ceiling effect was probably operating here, too, and possible method differences may have been obscured. It may well be the reason that Waugh found no Method x Group

interactions. The fact that he used a group instructional method necessitated a fixed time interval for each method presentation and this particular design would not have allowed him to collect a process measure had he wished to do so.

Bruininks (1968) used individual teaching sessions in his study but by making them a standard 23 minutes in length he also lost the opportunity to collect a measure of learning process differences. He found that his Ss learned equally well if taught to strengths or weaknesses. There was a trend toward higher performance on the Visual method for all Ss. This could have been due to differential difficulty between methods but with only the learning outcome measure collected it is difficult to clarify the point. It seems important to bear in mind for the design of future research, using individual or group teaching, that additional clarification of results can be gained by taking some measure of learning process as well as learning outcome.

Summary and conclusions. The original analysis of the three groups in the study did not demonstrate support for the hypothesis that learning of a word recognition task would be facilitated if boys with a specific reading disability were taught by a method which emphasized their perceptual mode strength. Possible reasons for the findings were discussed. The Auditory method was seen to be more difficult than the Visual and the word recognition task did

not appear to be demanding enough to demonstrate Method x Group differences if such did occur. The differences in the composition of the groups and the possible effect of these differences on the learning task were examined. The Visual group was found to be of higher IQ and younger than the other two groups. As a group, these Ss also appeared to be less severely disabled than the others. When three groups homogeneous for performance IQ were formed, it was found that the pattern of group differences did not change, although the overall level of performance was raised. Two groups homogeneous for age, Full Scale IQ, and severity of reading disability were also examined separately. It was seen that they did not differ on the number of trials taken to reach criterion when the method matched the mode on which they were both average, but they differed significantly when the method matched the mode that was strong for one group but weak for the other. Although the expected facilitation of learning was not shown by the experiment as a whole, it was felt that the data indicated that such an effect may occur. Discovering the relevant dimensions of group homogeneity would appear to be mandatory for future research. It would also seem advisable for further studies in this area to provide a longer experimental period to allow time for teaching effects to develop. The inclusion in the design of a measure of learning process in addition to the traditional measure of recall was found to be important for

providing additional clarification of results.

Implications. This study contains some implications for future research and remediation. One question to be answered concerns the effects of sensory mode deficits. Is there a difference in the severity of specific reading disability according to which sensory mode is weak? The answer would have obvious implications for remediation.

The area of methods requires further investigation to clarify in what respect the Auditory method was more difficult than the Visual. By the nature of the reading act it is virtually impossible to eliminate all visual or all auditory elements from any given method. It would be worthwhile, however, to isolate the essential elements and to work to develop methods as purely unimodal in presentation as possible. This would allow studies which could increase our knowledge of the reading process and its acquisition. Clarification is also needed as to which perceptual tests tap functions which relate most directly to the reading process.

There is a strong implication in the comparison of the perceptual test data that perceptual functioning can improve over time. This is in agreement with the findings of Silver and Hagin (1972), and Satz, Rardin and Ross (1971). There is also an indication in the data that such improvement may be slow to be reflected in performance. It would be well to bear in mind, then, that remediation which matches method to

stronger perceptual mode may require a considerable amount of time before the true effects can be judged.

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Appendix A

Description and Reliability Data for the Embedded Figures
Test and the Meikle Consonant Perception TestThe Meikle Consonant Perception Test (Meikle, 1970)

Forty-eight pairs of consonant-vowel-consonant groups are presented via tape recorder. Examples: man--dan, man--man, weed--weeg. The first two examples are taken from the practice samples given on the tape. The test pairs hold the vowel constant (ee) and may change the initial or final consonant. The S is required to indicate whether the two words are the same or different.

The Embedded Figures Test (Spreeen & Benton, 1969)

This test consists of 16 straight line stimulus figures which have to be traced in an "embedded" design. See Figure 7 for an example of a similar type to an actual Embedded Figures design. The stimulus figure remains exposed during the tracing. There is a time limit of 30 seconds per drawing. Scoring is done on the basis of 1 point for correct tracing plus 1 bonus point for completion within 20 seconds.

Norms were gathered on Victoria school children ages 6 to 15 years, with repeaters, children with known learning problems or behaviour problems, and children with known brain dysfunction excluded (Spreeen & Gaddes, 1969).

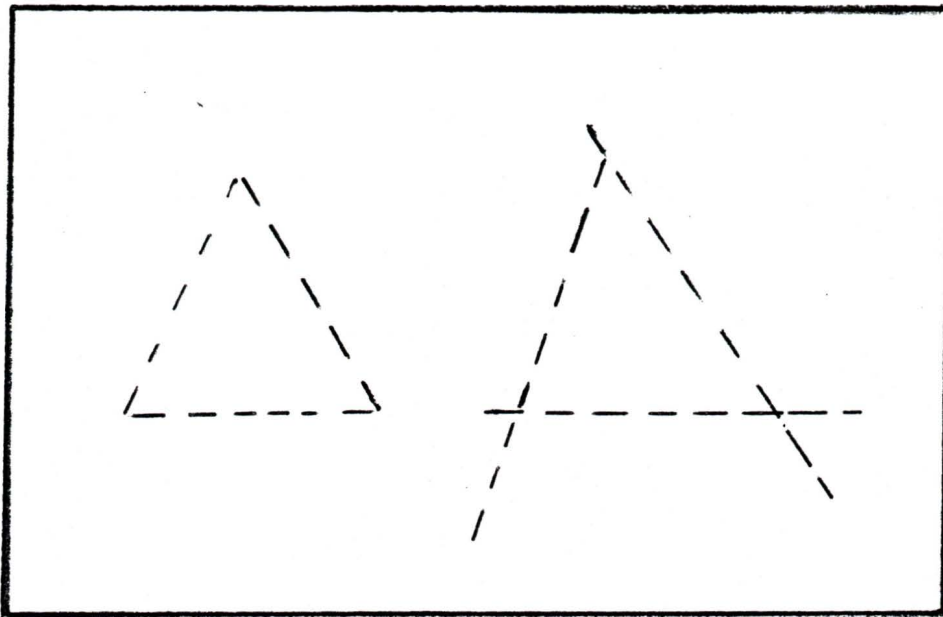


Figure 7 Design similar to the type used in the Embedded Figures test. Stimulus figure on the left to be traced in the figure on the right.

Reliability Study

In order to ascertain the reliability of the two tests used in this study, the Embedded Figures test and the Meikle Consonant Perception test were administered to 23 boys at Cedar Lodge School. (Of this group, 17 later became Ss in the research.)

The two tests were administered to the Ss on one day. E administered the Embedded Figures test and a psychometrician from the University of Victoria administered the Consonant Perception test. Three weeks later the two tests were re-administered. Again E gave the Embedded Figures test but a second psychometrician administered the Consonant Perception test. At the time of the second testing, 22 of the original Ss were available for re-testing.

When the raw scores for the Meikle Consonant Perception test were examined it was found that one S who had achieved a raw score of 45 on the first test scored 19 on the second, a difference of 26 points. Since the range of differences for the remaining Ss was from 0 to 9 and since the test is affected by attentional factors, it was decided to exclude this S.

A Pearson product-moment correlation was calculated for 21 Ss between the raw scores on the Meikle Consonant Perception test at Time 1 and Time 2 (three weeks later). A Pearson r of .785 was found.

A Pearson product-moment correlation was calculated for

22 Ss between raw scores on the Embedded Figures test at Time 1 and Time 2 and a Pearson r of .826 was found.

A Pearson r was also calculated between the Consonant Perception test and the Embedded Figures test at both Time 1 and Time 2 and the correlations were found to be: Time 1, r .373, and Time 2, r .361.

Appendix B

Perceptual Groups	Reading Retardation			
	4 years or more	2 - 4 years	1 - 2 years	6 mos- 1 year
Both	4	4	2	
Auditory	2	5	3	
Visual	3	0	4	3

The number of Ss in each of the three perceptual groups showing various degrees of reading retardation.

Appendix C

Visual Method

1. A word card with the stimulus word is presented with the statement: "This word is ____." The S repeats the word in answer to the question, "What is this word?" Have the S use the word in a sentence to ensure that he understands it.
2. The stimulus word is left before the S. Four other word cards (the discrimination stimuli) are presented. One is the same as the stimulus word, the other two closely resemble the stimulus word for initial letter, length of word, final letter, etc. S is asked to "look closely at these words and find (the stimulus word)." E points to the original stimulus card. When S finds the correct word he is again asked, "What is this word?" (If S points to the wrong word he is told, "No, that is not ____." This (indicating original stimulus) is ____." Look again." (S is helped to match, if necessary, by placing the original stimulus card directly above each of the three discrimination cards and drawing his attention to the differences.)
3. The original stimulus card is removed. The four discrimination cards are presented in a different order and the S is asked to find ____ from memory. (If S is unable to find the correct word from memory the stimulus card is presented again. S matches the word. The

- stimulus card is removed, the discrimination stimuli are presented in a different order and he selects the word. This is repeated until the word is correctly recognized.)
4. After all the words have been presented this way the original stimulus cards will be shuffled and presented one at a time. Each word which is correctly identified within 2 seconds will be recorded. Those that S fails to read will be re-taught following the steps outlined above. When all have been re-presented the stimulus cards will be shuffled and again presented one at a time to be read.
 5. This procedure continues until the criterion of one correct reading of the list is reached (or until the time limit of 20 minutes is reached).

Auditory Method

1. "Look at this word." Stimulus card is presented.
"Listen to me build this word." E places individual letters below the stimulus card, sounding out the word at the same time. (Digraphs, e.g., "ee", will be presented as one unit.) "Now you sound it." Point to individual phonemes and help S with sounds if necessary. When all sounds have been said, ask S, "What word is that?" Help him to blend if necessary. After S has identified the word, point out any silent letters. Have the S use the word in a sentence to check on his understanding.

2. The stimulus card is left in front of S. The individual letters are mixed up and S is instructed, "Now you build _____ and say the sounds as you make the word." E prompts the sounding of the letters, if necessary having the S repeat the sounds after him. "What is the word?" S repeats the word.
3. Remove the stimulus card. Mix up the letters and have S construct the word from memory by sounding it as he makes it. "Now make _____ from memory and say the sounds as you make it." When S has correctly made the word, present the stimulus card and ask, "What word is this?" (If S makes the word incorrectly, help him to sound out the error and correct it by sounding the stimulus word with him. If necessary E makes the word again, slowly sounding it and having S actually place the letters in position. Then S is asked to do it again himself, always sounding the word out as he does so.)

Continue with steps 4 and 5 as outlined under the Visual Method.

Appendix D

Word Lists Used for One S

Age: 10

Reading level: approximately 1.9

	<u>List 1</u>	<u>List 2</u>
phonetic	desk	gift
	fork	drum
	cabin	canal
	wigwam	insect
non-phonetic	loaf	toad
	doubt	guess
	piano	heavy
	circle	castle

Appendix E

Analysis of the Performance of Three Groups

Homogeneous for Performance IQ

Using the criterion for inclusion of Performance IQ > 80, it was found that four Ss in the Auditory group were excluded. Ss were then selected from the Visual and Both groups to match the Performance IQ of the reduced Auditory group as closely as possible. This selection resulted in three groups, each with $N = 6$ and the following mean IQs: Both--93.33, Auditory--92, and Visual--103.16. An analysis of variance revealed that there was no significant difference between groups on the Performance IQ (F 1.60, df 2, 15, $p > .05$). (See Tables XIV and XV.)

A repeated measures analysis of variance was carried out on the Recall, Trials to Criterion, Time to Criterion, and Words per Minute measures. Summary tables of the analyses are reported in Tables XVI through XIX. The means are presented graphically in Figures 8 through 11.

On all four measures the method effect was significant. The Visual method proved more effective. As well, on the Recall measure a Method x Group interaction was found which approached significance ($p = .07$). However, examination of the means showed that this interaction effect was due solely to the Both group which recalled more words by the Visual method.

TABLE XIV

Means of Groups Matched on WISC Performance IQ

Group	Mean	Range	SD
Both	93.3	83 - 104	8.77
Auditory	92.0	80 - 108	11.49
Visual	103.2	82 - 122	14.42

TABLE XV

Summary Table for the ANOVA on Performance IQ

Source	<u>SS</u>	<u>df</u>	<u>MS</u>	<u>F</u>	<u>p</u>
Between	446.33	2	223.16	1.61	>.05
Error (within)	2090.16	15	139.34		

TABLE XVI

Repeated Measures ANOVA on Recall for
Three Perceptual Groups Matched on Performance IQ

Source	<u>SS</u>	<u>df</u>	<u>MS</u>	<u>F</u>	<u>p</u>
Subjects	123.25	17			
Percept. Group	10.50	2	5.25	0.70	.513
Error (between)	112.75	15	7.52		
Method	4.69	1	4.69	6.76	.020
Method x Group	4.39	2	2.19	3.16	.071
Error (within)	10.42	15	0.69		
Total	19.5	18			

TABLE XVII

Repeated Measures ANOVA on Trials to Criterion for
Three Perceptual Groups Matched on Performance IQ

Source	<u>SS</u>	<u>df</u>	<u>MS</u>	<u>F</u>	<u>p</u>
Subjects	1069.81	17			
Percept. Group	140.39	2	70.19	1.13	.348
Error (between)	929.42	15	61.96		
Method	96.69	1	96.69	10.33	.006
Method x Group	35.39	2	17.69	1.89	.185
Error (within)	140.42	15	9.36		
Total	272.5	18			

TABLE XVIII

Repeated Measures ANOVA on Time to Criterion for
Three Perceptual Groups Matched on Performance IQ

Source	<u>SS</u>	<u>df</u>	<u>MS</u>	<u>F</u>	<u>p</u>
Subjects	2508.81	17			
Percept. Group	116.06	2	58.03	0.36	.701
Error (between)	2393.75	15	159.52		
Method	462.25	1	462.25	15.65	.001
Method x Group	138.17	2	69.08	2.34	.130
Error (within)	443.08	15	29.54		
Total	1043.5	18			

TABLE XIX

Repeated Measures ANOVA on Words per Minute for
Three Perceptual Groups Matched on Performance IQ

Source	<u>SS</u>	<u>df</u>	<u>MS</u>	<u>F</u>	<u>p</u>
Subjects	1.67	17			
Percept. Group	0.15	2	0.08	0.76	.486
Error (between)	1.51	15			
Method	0.29	1	0.29	9.31	.008
Method x Group	0.13	2	0.07	2.12	.154
Error (within)	0.47	15	0.03		
Total	0.90	18			

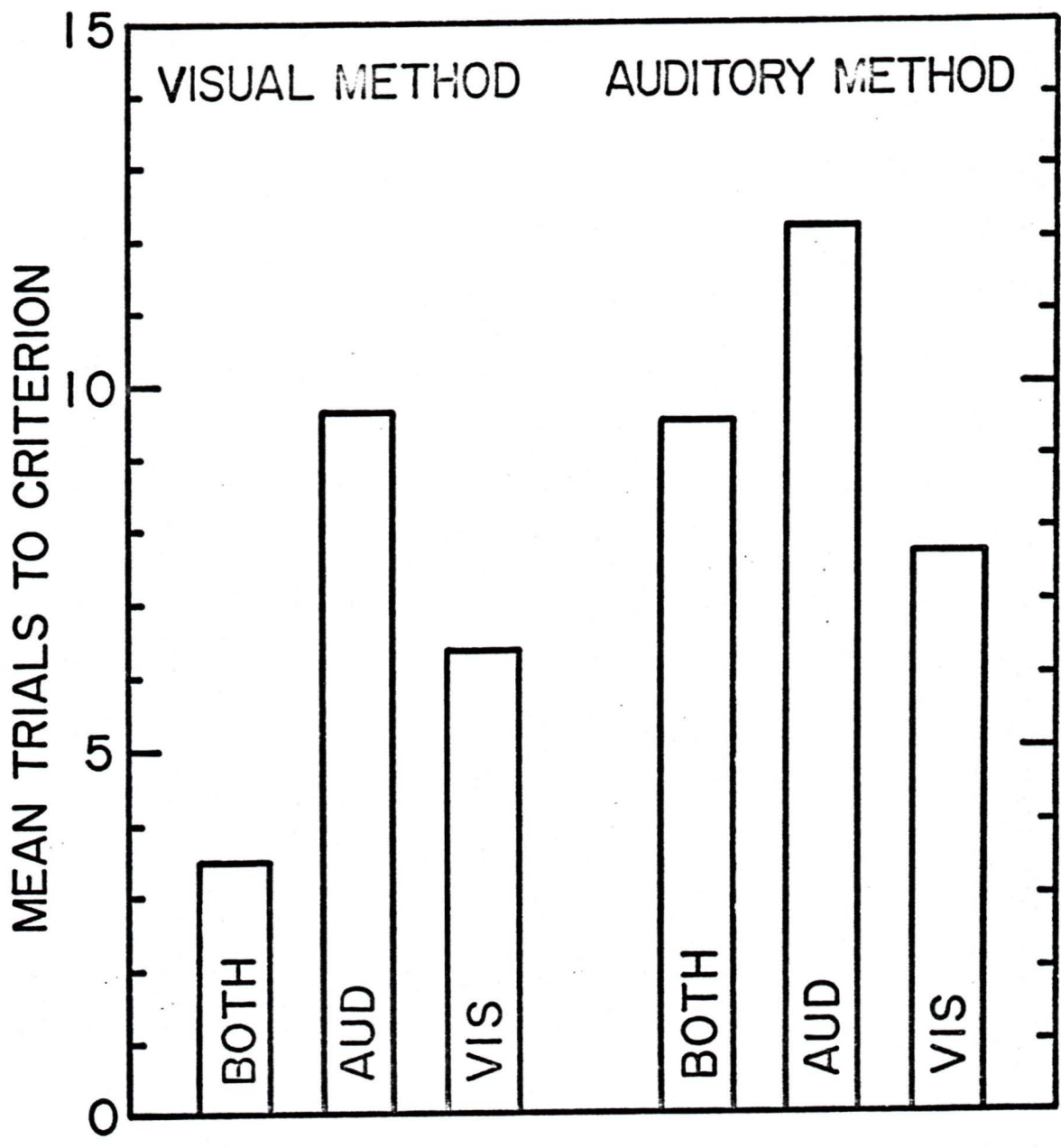


Figure 8 Trials to criterion for Ss matched on Performance IQ, grouped according to two perceptual tests and taught by two methods.

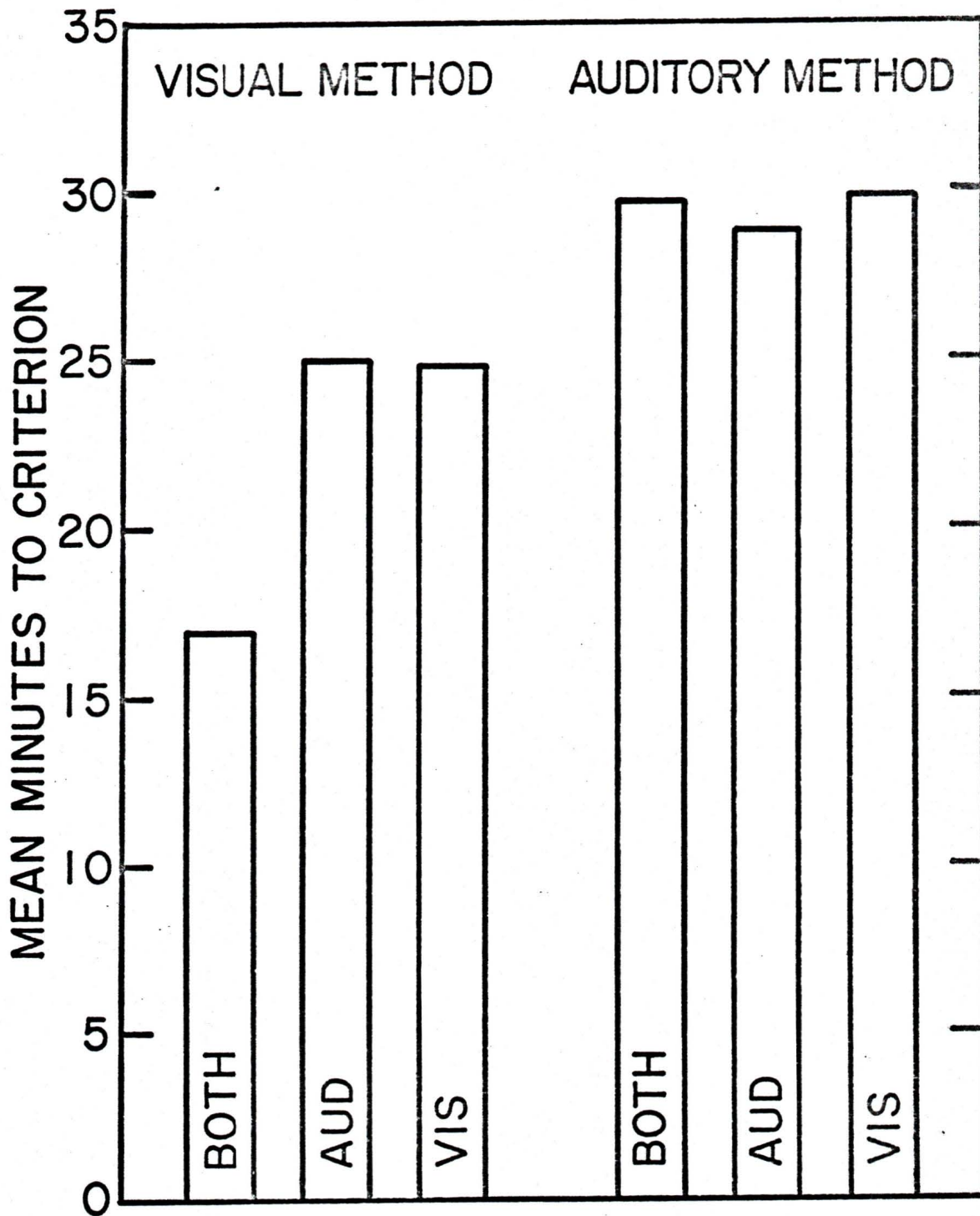


Figure 9 Time to criterion for Ss matched on Performance IQ, grouped according to two perceptual tests and taught by two methods.

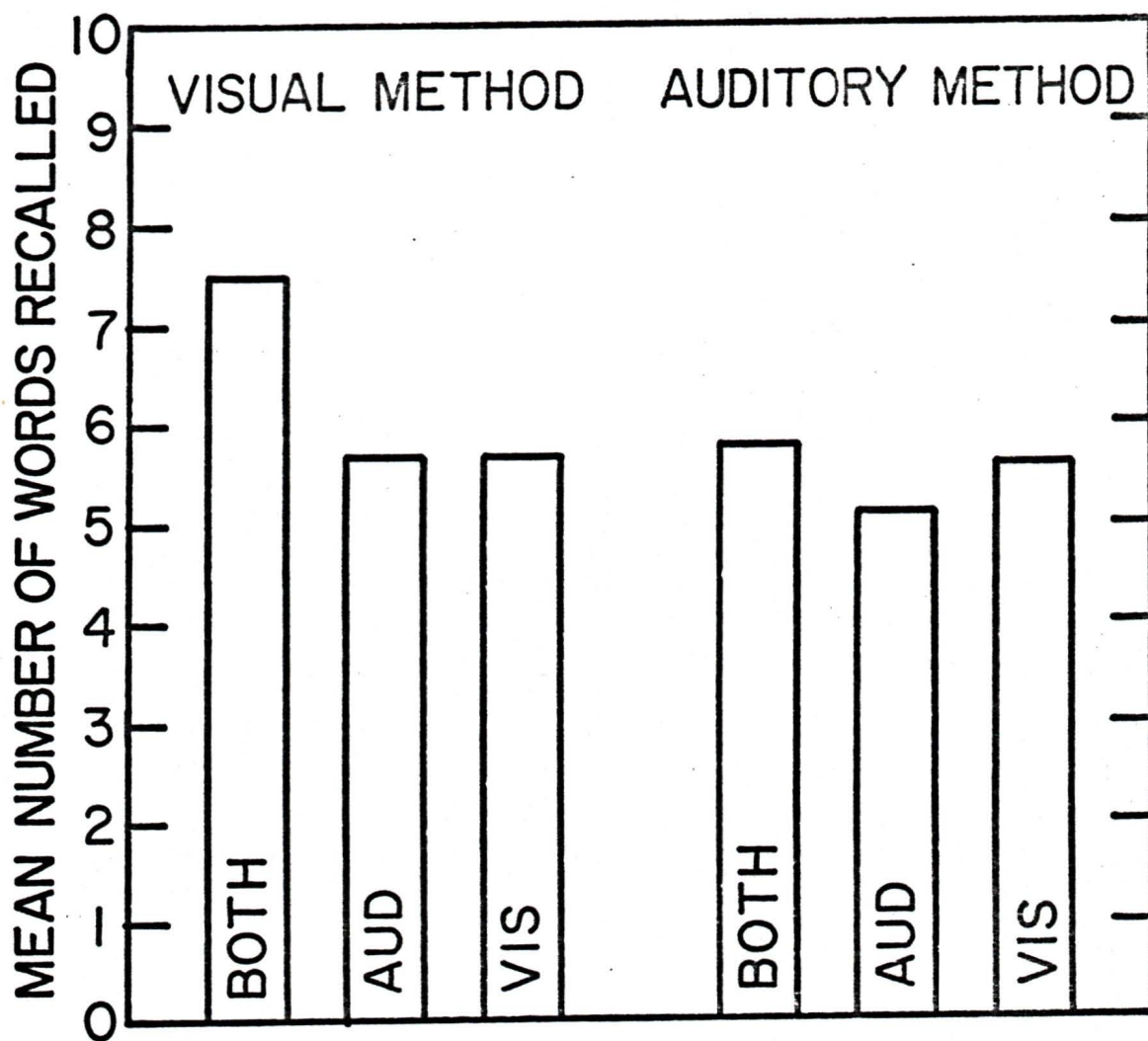


Figure 10 Recall for Ss matched on Performance IQ, grouped according to two perceptual tests and taught by two methods.

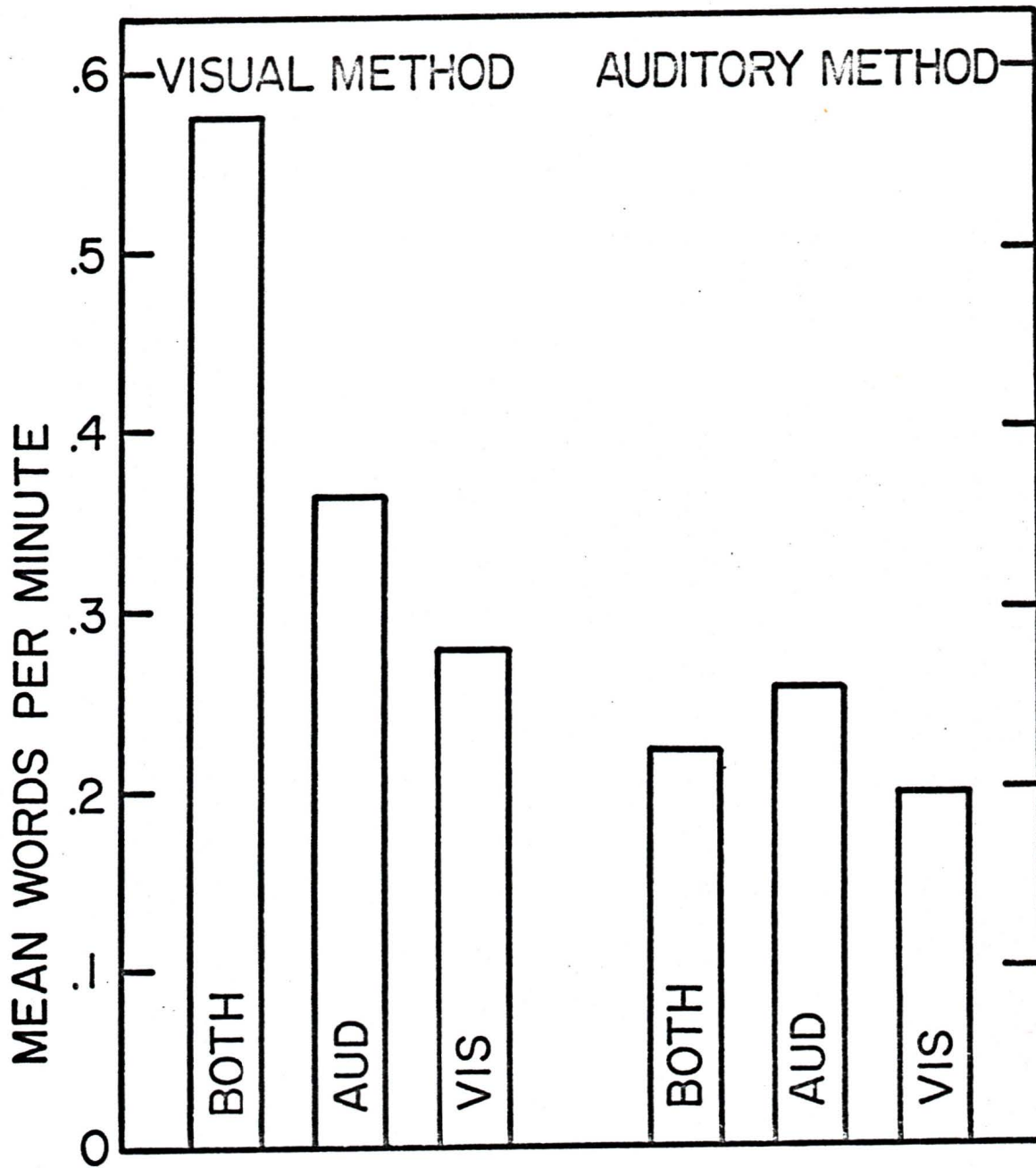


Figure 11 Words per minute for Ss matched on Performance IQ, grouped according to two perceptual tests and taught by two methods.

It can be seen by comparing Figures 1 to 4 with Figures 8 to 11 that creating groups homogeneous for Performance IQ raised the overall level of performance relative to the original non-homogeneous groups. This improved performance was particularly marked for the Trials measure. The pattern of group responses remained unchanged from that of the original group and the performance of the Visual group on the Recall measure was still contrary to the pattern exhibited by the other two groups.


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THE RELATIONSHIP BETWEEN PERCEPTUAL MODALITY STRENGTHS
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Oct. 10, 1974

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