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UNIVERSITY OF ALBERTA

DECODING IN GIFTED/LD STUDENTS: A PROCESS-BASED REMEDIAL APPROACH

BY

SHAWN A. S. CRAWFORD 

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled DECODING IN GIFTED/LD STUDENTS: A PROCESS-BASED REMEDIAL APPROACH submitted by SHAWN ALLAN STEPHEN CRAWFORD in partial fulfillent of the requirements for the degree of MASTER OF EDUCATION in SPECIAL EDUCATION.

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Abstract

Some students with significantly above average intellectual potential have also been found to display specific learning disabilities. Problems in reading, and specifically decoding, in this group have often been noted concurrently with deficits in successive processing. A process-based remedial program has been developed which combines global training on tasks involving successive processing with tasks involving the application of successive strategies to academic material. This program also provides guided practice and verbal mediation during training to assist students in internalizing and generalizing these strategies.

The purpose of the present study was to determine whether decoding skills of gifted learning disabled students could be improved by this program. Improvements were noted on successive processing marker tasks as well as in basic decoding skills and comprehension. However, these improvements were not consistent between students. It was concluded that, while the present remedial method may improve successive processing skills, these improvements may be manifested differently in each student depending on their particular processing abilities and preferred reading strategies. Further, non-cognitive variables, such as motivation and attention, may also play a role in determining the benefit derived from this program. Finally, application of general strategy training to a specific academic domain such as reading must take into account the specific nature of the relationship between processing and performance in order to remain consistent with the academic task and to maximize transfer.

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CHAPTER I

Giftedness and Learning Disability - Issues in Identification and Programming

It has been the practice in special education to classify special needs students according to a single form of exceptionality. It is not uncommon, however, for a child to display behaviors characteristic of more than one category. For example, learning disabled children can often meet the criteria for classification as behaviorally disordered (Zable, 1987). Moderate to severe mental retardation can occur concurrently with visual impairment (Hammer, 1987). Creativity or giftedness may be found in hearing impaired children (Yewchuk & Bibby, 1989).

The categories of gifted and learning disabled, however, appear at face value to represent mutually exclusive classifications of special needs children, existing at clearly different points on a continuum of intellectual and/or academic ability. Giftedness is often defined as significantly above average intellectual ability coupled with superior school achievement and/or exceptional talent in a specific area of performance (Renzulli, Reis, & Smith, 1981). Learning disability, on the other hand, is usually defined as a disorder in psychological processing which affects language and results in poor performance in one or more academic areas despite average intellectual ability (Education of the Handicapped Act, 1986).

Given these currently accepted definitions of giftedness and learning disabilities, the notion of characteristics from these categories appearing concurrently within the same individual appears initially to be a contradiction in terms. However, it has recently been recognized that these two forms of exceptionality are not necessarily independent of one another, and children who display superior intellectual potential may not achieve to their potential because of a specific learning disability (Tannenbaum & Baldwin, 1983). While such children often display characteristics common to many

definitions of giftedness, such as superior intellectual potential, very good conceptual understanding, and high verbal expressive ability, they also demonstrate the significant delays in basic academic skills that characterize learning disabled children (Gunderson, Maesch, & Rees, 1987; Suter & Wolf, 1987; Yewchuk, 1986). The discrepancy between these areas of intellectual strength and academic weakness is often much greater than typically found in learning disabled children of average intelligence (Yewchuk, 1984). Since this discrepancy between potential and achievement appears to be the most specific and relevant identifier for students who might otherwise be classified as gifted, but who are unable to achieve a "gifted" level of functioning, the terms "high potential/learning disabled" (HPLD) and gifted learning disabled will be used interchangeably.

Identification of HPLD students is often very difficult due to current methods of assessment and classification within school systems, as well as preconceptions regarding these two forms of exceptionality. Many of these children may still perform in the average range of achievement (Suter & Wolf, 1987). As a result, such individuals may pass through the school system with both superior potential and specific disability remaining unrecognized. HPLD children often fall into one of three broad groups in terms of how they are misperceived and misclassified in school (Yewchuk, 1986).

The first group of students who are not appropriately identified consists of those who are achieving at or close to grade level in school. These children may use their intellectual strengths to compensate for their specific learning disabilities, with the overall effect being average or near average academic performance (Gunderson, et al., 1987; Suter & Wolf, 1987; Yewchuk, 1986) These students are recognized for neither their superior potential nor their specific learning disability, and, therefore, are not considered as potential candidates for intellectual or academic assessment, or special instructional programming. Further, group achievement tests, which are typically administered to all children in a school system to screen for potential learning

problems, may also fail to identify specific strengths or weaknesses within the gifted/LD student (Gunderson et al, 1987). The reason for this is that group achievement tests usually require adequate reading skill, and since HPLD children often experience difficulties in reading (Bow, 1987; Fox, 1983), strengths in areas such as fund of knowledge, conceptual ability, or problem solving, may be masked by an inability to adequately read the questions. Therefore, group tests may not provide the opportunity for these children to demonstrate their areas of strength, and reveal only average performance.

Another category of misidentified HPLD children are those who are classified as learning disabled, but who are not recognized as possessing superior intellectual potential (Gunderson, Maesch, & Rees, 1987; Suter & Wolf, 1987; Yewchuk, 1986). This classification may occur if the specific learning disability is so severe that the student cannot adequately compensate by using his/her strengths, and therefore does not achieve passing grades in school. Although the nature of the exceptionality in these cases has been partially identified, instructional programming usually emphasizes basic training in weak academic areas, with strengths being recognized only as possible tools for compensatory remediation of weaknesses (Gunderson et al., 1987). While training in basic academic areas is important, this type of instruction usually involves extensive drill with low interest materials. Therefore, this special instruction may not meet the needs of the gifted/LD child for enriched intellectual stimulation in the areas in which he/she is strong. As a result, these children may become disinterested and lack motivation to perform in school, and thus may put forth only minimal effort.

The final category of HPLD children are recognized as possessing superior intellectual potential, and not achieving to that potential in school (Jones, 1986; Yewchuk, 1986). Recognition of this discrepancy, however, may not necessarily lead to appropriate instructional programming. These children often present as distractible and disruptive in class (Waldron, Shapire, & Rosenblum, 1987), and, therefore, are

perceived as possessing attentional or motivational problems. Therefore, rather than receiving further assessment and programming modifications to meet their academic needs, attempts are often made by teachers and counsellors to reduce disruptive behavior and encourage these children to work harder in school. It may be the case, however, that they are already working hard, and require further assistance in order to achieve to their fullest potential.

As a result of the aforementioned difficulties in identifying HPLD children, several researchers (eg. Fox, 1983; Suter & Wolf, 1987) have advocated a multi-dimensional assessment procedure for the identification of such students. Research in this vein has attempted to determine whether common patterns of performance in areas such as achievement, self-concept, and cognitive functioning, exist within this group. In the next sections some common characteristics found among HPLD students in each of these areas will be discussed.

Achievement

Although HPLD children display a great deal of variability in areas of academic strength and weakness, several studies have found common patterns of achievement in this group. Such students tend to display strengths in verbal comprehension, expression, and the ability to understand concepts, therefore performing very well in classroom or small group discussions as well as oral question/answer types of activities in subjects such as Science and Social Studies (Gunderson et al., 1987, Suter & Wolf, 1987). In the area of arithmetic, word problem solving abilities may also be very strong (Udall & Maker, 1983).

Despite these verbal strengths, HPLD children often experience difficulties in basic academic skills. They have been noted to be particularly poor in written expression, especially in the areas of spelling, punctuation, capitalization, and paragraph structure (Gunderson et al, 1987). They may also display below average

performance in basic reading skills, reading comprehension, or basic mathematical skills (Udall & Maker, 1983).

This dichotomy between verbal-conceptual abilities and basic academic skills can be very difficult for these children to accept (Gunderson et al, 1987; Suter & Wolf, 1987; Waldron et al., 1987). They often cannot understand why they can comprehend and discuss concepts on a very advanced level for their age, but have great difficulty in basic academic skills in domains such as reading or arithmetic. Because of the frustration resulting from large discrepancies between intellectual potential and achievement, HPLD children often possess poor self-concept, and may become easily frustrated with school work (Gunderson et al., 1987; Waldron et al., 1987).

Self-Concept

Frustration and poor self-concept in HPLD children may manifest in problem behavior in class, a negative attitude towards school, or social isolation from peers (Gunderson et al., 1987). A recent study by Waldron et al. (1987) compared a group of normally achieving gifted students to underachieving gifted students on the Piers-Harris Self-Concept Scale (Piers, 1969). These authors stated that feelings of low self-concept may interact with specific learning deficits and environmental factors to depress achievement. They found that the underachieving students consistently displayed lower self-concept scores than their normally achieving peers in all areas assessed by the Piers-Harris, with largest differences observed in the area of intellectual and academic functioning.

Waldron et al. also noted differences in the types of problem behavior displayed by the two groups. The normally achieving gifted children tended to display more disruptive behaviors, including getting out of their seats and talking to others. Waldron et al. inferred that these behaviors indicated boredom due to lack of sufficient stimulation for the gifted youngsters in the regular classroom. The underachieving

students, however, demonstrated more passive behaviors, such as daydreaming, asocial behavior, and displaying inappropriate emotional responses (eg. crying when asked to do an assignment). Waldron et al. stated that this type of passive behavior may stem from anxiety over performing class work. Therefore, while the student is not performing the work, he/she is also not drawing attention to him/herself, thus temporarily masking more serious learning problems.

Cognitive Functioning

The discrepancy between verbal, conceptual, and problem solving abilities and basic academic skills in HPLD students suggests that these children may possess specific cognitive deficits. One cognitive difficulty which has been commonly found in HPLD children occurs in successive processing (eg. Bow, 1987; Hansford, Whitmore, Kraynak, & Wingenbach, 1987; Snart, Das, & Mensink, 1988). Successive processing refers to processing material in discrete, serial order, such as remembering a telephone number or decoding printed text, where encoding of a portion of the information is dependent on its serial position among other items (Das, Kirby, & Jarman, 1979). An example of this type of processing would be a request to state the fifteenth letter of the alphabet. The respondent would probably start at the beginning of the alphabet and count through the letters until he/she reached the fifteenth. The converse of successive processing is simultaneous processing, which refers to synthesizing information into groups. This information can take on spatial overtones, and any portion of the information can be immediately detected regardless of its position in the group. Stimuli which may be coded this way are music or paintings. In music, for example, the sounds of all of the instruments are encoded together at the same time, with the overall perception being the musical piece.

Evidence for the existence of successive processing deficits in HPLD children has been provided by research which has used Wechsler Intelligence Scale for Children-

Revised (WISC-R) to determine whether common ability profiles exist among such students (Bow, 1987; Daniels, 1983; Fox, 1983; Schiff, Kaufman, & Kaufman, 1981; Udall & Maker, 1983). Although some variability has been noted in the performance of HPLD children on the WISC-R, a relatively consistent pattern of strengths and weaknesses has also been found. Subtests which have commonly been found to be particularly high, falling within the Very Superior to Superior range, include those requiring verbal comprehension, expression, and conceptual abilities, such as Similarities, Information, and Comprehension. Somewhat lower scores are usually found on subtests involving visual-spatial perception and organization, including Picture Completion, Object Assembly, and Block Design. Scores for these subtests often fall within the Superior to High Average range. The lowest scores consistently found in the WISC-R performance of HPLD children are on subtests such as Arithmetic, Digit Span, and Coding. Scores on these subtests, while usually significantly lower than the overall average performance of HPLD children, often still fall within the Average range when compared to the general student population.

This pattern of low scores often found in HPLD children (Arithmetic, Digit Span, Coding) is one which has been related to factors such as inattention, disinterest, low motivation, or anxiety in the testing situation (Kaufman, 1979). However, each of these subtests also requires some form of sequential analysis or processing. For example, in Digit Span students must remember and reproduce a series of digits in sequential order, thus requiring skills in sequential memory. Arithmetic also requires sequential memory, since the student must retain the necessary components of the questions in sequential order long enough to solve the problem. Coding requires students to match numbers to a series of symbols in sequential order without skipping, thus requiring successive visual scanning. Therefore, another possible reason for the consistently poor performance found in HPLD children on these subtests is poor successive processing ability. However, these subtests are not direct measures of

successive processing, suggesting that further evidence is required in order to infer that successive processing deficits exist in HPLD children.

Such evidence was provided by Hansford, Whitmore, Kraynak, and Wingenbach (1987) who assessed successive processing in HPLD children as part of an assessment battery for the identification of such children. These researchers used the Kaufman Assessment Battery for Children (K-ABC) (Kaufman & Kaufman, 1983), an assessment device which examines the cognitive processing of children in terms of successive and simultaneous processing. The hypothesis put forth by these authors was that, since gifted children have often been found to perform exceptionally well on simultaneous types of tasks, such as discussing complex concepts or solving multi-faceted problems (Wolf & Gygi, 1981), and since learning disabled children have often been found to perform poorly on tasks requiring successive processing (Das & Cummings, 1977) that simultaneous processing in HPLD children would be significantly superior to successive processing. However, when analyzing the patterns of processing in the HPLD group, Hansford et al. found no overall difference between simultaneous and successive processing. Upon closer examination of the performance of individual students it was discovered that, although all of the males in the group possessed significantly superior simultaneous processing in comparison to their successive processing, the female subjects in the sample demonstrated the opposite pattern of performance. This data suggested that gender may be a possible confounding factor, and when the data for the female subjects was removed from the analysis, simultaneous processing was found to be significantly superior to successive processing. The authors inferred from these results that successive deficits may characterize the cognitive functioning of HPLD students, but may be more consistently represented in males.

The aforementioned research suggests that the relative depression in achievement found in HPLD children may be related to common patterns of cognitive functioning, characterized by high verbal expression and comprehension as well as relatively low

successive processing ability. Investigations of cognitive processing in LD students of average intellectual potential has provided evidence for a relationship between successive processing deficits and difficulties in reading (Das & Cummings, 1977; Hooper & Hynd, 1986; Kirby & Robinson, 1987; Solan, 1987). Similar difficulties in basic reading skills have also been observed in HPLD children (Udall & Maker, 1983). Therefore, deficits in successive processing may also be related to reading difficulties in the HPLD group.

Successive Processing and Reading in Learning Disabled Students

Both simultaneous and successive processing have been found to be adequate in proficient readers (Cummings & Das, 1977; Solan, 1987) and deficient in students with reading disabilities (Leong, 1974; Sahu & Devi, 1984; Snart, Das, & Mulcahy, 1982). According to Das et al. (1979), decoding print involves the sequential analysis of letters, syllables, and words, and thus appears to be successive in nature. Comprehension in reading, however, involves summarization, synthesis, and the use of context to understand written passages, and therefore is more closely related to simultaneous processing.

Although both types of processing appear to be involved in reading, some studies have found that deficits in successive processing appears to be more closely related to reading problems (Das & Cummings, 1977; Hooper and Hynd, 1986). For example, in a comprehensive study of reading and cognitive processing, Kirby and Robinson (1987) tested 105 reading disabled children on simultaneous and successive processing and reading skills. Using factor analysis, they found that the children's reading performance fell into three factors. These were a) reading miscue, which was inferred to involve the use of context in reading, b) whole word recognition, involving sight vocabulary, and c) word analysis, involving sound-symbol correspondence and basic decoding skills. The last factor was expected to be highly related to successive processing. However, Kirby

and Robinson found that all three reading factors correlated with simultaneous processing, while non of the factors correlated with successive processing. The authors inferred from these results that the reading disabled students were employing simultaneous strategies in tasks which would be more efficiently performed using successive strategies. This could be due to a deficit among LD children in successive processing, or a lack of awareness concerning when to employ a successive strategy appropriately. In either case, these authors concluded that disabled readers displayed a deficiency in employing successive strategies when reading, indicating a need for remedial assistance in this area.

Several remedial studies have involved successive process training, and have improved such processing in disabled readers. Further, these improvements have transferred to decoding skills such as word recognition. For example, Krywaniuk (1974; see also Krywaniuk & Das, 1976) provided 15 hours of remediation on successive global tasks to native Indian children who were diagnosed as "slow learners". This author found significant increases in performance on successive processing tasks, and improvement in word recognition on the Schonell Graded Readiness Vocabulary Test (Schonell, 1968). Kaufman (1978) provided training to learning disabled students on both successive and simultaneous tasks, and also found improvements in successive processing and word recognition. Brailsford, Snart, and Das (1984) provided 15 hours of remediation to reading disabled students using simultaneous and successive tasks, and found improvements in successive performance as well as instructional reading level as measured by the Standard Reading Inventory (McCracken, 1966). These studies indicate that training in successive processing may be beneficial in improving basic reading skills in disabled readers.

Reading and Successive Processing in HPLD Students

Evidence has also suggested that HPLD children who are experiencing reading difficulties may possess successive processing deficits. Fox (1983) examined the WISC-R performance of children with superior intellectual potential (IQ $\geq$ 125) who had been referred to the Temple University Reading Clinic because of suspected reading disability. A pattern of performance similar to that found in previous research was again discovered, with highest scores observed on subtests requiring verbal comprehension and expression (Similarities, Comprehension, Vocabulary) and lowest scores on subtests requiring sequential ability, attention, and concentration (Digit Span, Arithmetic, Coding). These results suggest that difficulties in successive processing may be related to problems in reading among HPLD children. Further, as found in previous studies, the subtests on which these students performed most poorly, while significantly lower than their other scores, still fell within the Average range of performance. It was also noted that only 10% of the students referred because of suspected reading difficulties actually obtained scores on standardized reading assessments which would qualify them for remedial reading assistance (two years below grade level). The author concluded from these data that these students may often go unrecognized because their disability is not severe enough to outweigh their strengths and result in below grade-level reading performance. It was suggested that an informal reading inventory, with emphasis on discrepancy between listening comprehension and instructional reading level, may be useful in identifying gifted students who are underachieving in reading.

A more extensive cognitive assessment battery was used by Bow (1987) to study reading in HPLD children. This author compared cognitive functioning of intellectually superior (IQ $\geq$ 120) reading achieving or underachieving males using tests of intellectual potential, linguistic processing, auditory attention span, and visual-spatial skills. The reading underachieving individuals were identified by referral from school

as well as significantly inferior reading performance on the reading subtest of the Wide Range Achievement Test-Revised (WRAT-R) (Jastak & Jastak, 1978) and the Gray Oral Reading Test (GORT) (Gray, 1967) compared to the achieving group. This study again revealed patterns of cognitive abilities on the WISC-R which were similar to those found in previous studies, with the reading underachiever group scoring significantly lower in Digit Span than the reading achiever group. Further, the reading underachieving children were also found to be inferior on the Token Test (Noll & Lass, 1979). This is a test of linguistic processing which uses non-curriculum type materials to test for receptive language abilities by requiring the student to follow a series of instructions, and which measures abilities in relational understanding and sequencing. Another test in which the reading underachievers were found to perform significantly worse than the reading achievers was the Auditory Attention Span Subtest of the Detroit Test of Learning Aptitude (DTLA) (Baker & Leland, 1967). This task involves short-term auditory memory and auditory sequencing. Bow concluded from these results that psychological functions in which the intellectually superior reading underachieving children appear to be inferior to intellectually superior reading achieving children were auditory short-term memory, auditory sequencing, orientational/relational concepts, linguistic processing, attention, and concentration. Successive processing is evident in many of these tasks, lending further support for a relationship between successive processing and reading. However, it was again noted that even these inferior skills were still average in comparison to normal achieving children. Bow concluded that psychological and reading performance that is in the average range cannot always be assumed to be intact, and that such performance may indicate relative weaknesses within the individual which require educational intervention.

A more direct examination of the relationship between successive and simultaneous processing deficits and reading difficulty in intellectually superior children was conducted by Snart, Das, and Mensink (1988). They compared high IQ/LD

and average IQ/LD groups, both of which displayed significant deficiencies on the decoding subtest of the Schonell Reading Test (Schonell, 1968), to high IQ/non-LD and average IQ/non-LD groups. They found all LD students to be poorer in both successive and simultaneous processing tasks when compared to IQ matched peers. A comparison of the LD groups, however, found the high IQ/LD group to be significantly superior to their average IQ peers on simultaneous processing, but not significantly different from the average IQ/LD on successive processing.

These data support the conclusions of Hansford et al. (1987) that HPLD children often possess superior simultaneous processing in comparison to successive processing. Snart et al. inferred that, when performing simultaneous tasks, HPLD children use their superior abilities in order to compensate for specific processing weaknesses. They lose their advantage, however, when performing successive tasks, and are thus unable to compensate for specific disabilities. These authors suggested that a similar situation may occur in school, where in the first few years gifted/LD children are able to compensate for specific weaknesses in areas such as decoding or short-term memory through strengths in predictive ability, sight word vocabulary, conceptual ability, or verbal expression. At some point, however, the task demands may become such that they can no longer compensate effectively, at which time a successive deficit may become apparent.

In summary, children who demonstrate superior intellectual potential, but who also possess a specific learning disability, represent a paradox within our conceptions of these two categories of exceptional children. Although they are often difficult to identify, these children do exist, and research examining the characteristics of these children has revealed some commonalities in terms of achievement and cognitive processing. One processing area which is often weak in HPLD children is successive processing, and research investigating performance in both LD and HPLD students has suggested that this weakness may be related to difficulties in basic reading skills.

An important issue involves how to provide appropriate instructional programming for HPLD children. The aforementioned research has indicated that providing training in successive processing strategies can lead to improvement in the reading skills of disabled readers (Brailsford et al., 1981; Kaufman, 1978; Krywaniuk, 1974). If HPLD students suffer from similar reading difficulties, these children may also benefit from such training. In the following section a model is presented which focuses on training successive processing strategies, and relates these processes to reading skills.

The Development of a Remedial Model

A model which attempts to examine the cognitive deficits that underlie academic problems has been under development for several years. This model is based on Luria's (1963) Information Integration theory. Following an examination of brain injured patients, Luria developed a neurological model which organized the brain into 3 functional units, each responsible for a different aspect of information processing. The first unit controls arousal, or the attention to stimuli which is necessary for learning to occur. The second unit is responsible for encoding of information, and is divided into simultaneous and successive processing. The third unit is involved in planning, or utilization of information in organizing a plan of action. These three areas operate together in an integrated manner to process, store, and utilize information.

From Luria's early work, Das and his associates (Das, Kirby, & Jarman, 1979; Das & Naglieri, 1989) have further developed the Information Integration theory, and have produced the Cognitive Assessment System (CAS) to test children's level of functioning in each of the aforementioned processing areas. A major focus in assessment is the simultaneous/successive coding component. Both of these types of processing are believed to be involved in all information processing activities. The extent to which either simultaneous or successive processing is utilized in performing a cognitive task

depends on the nature of the task and the preference of the individual for using one or the other type of processing.

A remedial model based on the CAS, the Coding, Attention, and Planning (CAP) model (Das, Kirby, & Jarman, 1979; Naglieri & Das, 1988) has also been under development for several years. This method was designed to remediate deficits in successive and simultaneous processing, attention, and planning through strategy training with a series of non-academic tasks. Following Vygotsky's (1978) theory of inductive learning, processing strategies involved in these areas are not trained directly, but are taught inferentially through exposure to several tasks, each of which focuses predominantly on one specific processing component (simultaneous or successive processing, attention, or planning). In this way the student can internalize the common strategies required in the performance of the tasks. The following sections will outline in detail the rationale behind this remedial model, focusing on its inductive learning approach and general strategy training method. The model will also be examined in comparison to other common process training models in order to highlight its unique features.

Global Process Training

A major component of the CAP model involves training global processing strategies without the use of specific academic content. That is, the training does not involve academic activities, such as reading printed text or solving mathematical problems, and does not teach academic content, such as specific words or mathematical facts. One reason for teaching strategies which are free from academic content is that children may respond better motivationally to content-free tasks because they do not produce the expectancy of failure often associated with academic material (Das & Conway, in press; Feuerstein, 1979). Students who have experienced failure in school subjects may be reluctant to attempt tasks which appear to be school related (Stanovich,

1986). Content-free tasks, however, may not produce this failure expectancy. Therefore, the students may put more effort into performing the tasks and learning the strategies.

Another reason for using content-free training is to ensure that the student's focus is on the strategy being taught, and not on learning the specific material being used in the instruction (Das & Conway, in press; Deshler, Alley, Warner, & Schumaker, 1980). If specific academic content is used, skills may become linked only to these materials, and students may not learn the underlying strategies being taught or how to transfer them to new material in school. Students may thus become dependent, passive learners who rely on the teacher to inform them of what they must do in each new situation (Brown & Campione, 1986; Das & Conway, in press).

Evidence of the problem of limited transfer using specific academic content has been found in studies involving direct strategy training for particular academic tasks. For example, Torgesen and Goldman (1977) attempted to teach specific rehearsal strategies to reading disabled students, but obtained little transfer to material outside of the instructional context. Other researchers (eg. Davis & Annis, 1979; Wade & Trathen, 1989) have taught note taking and underlining as strategies to improve recall and comprehension of text, but found them to have little benefit over simply reading the text.

Another method which focuses on training with specific academic content is Direct Instruction (eg. Carnine & Silbert, 1979). Here skills are taught in a very specific and functional manner through task analysis and behavioral techniques. Although this method may be useful for teaching specific material in certain contexts (Gersten, 1985), generalization of training in areas such as reading (Das, 1985) and language (Spradin & Siegel, 1982) remains a problem. Donnellan and Neal (1986) stated that the more specialized a learning environment is, the less likely that it will generalize to the complex, integrated environments in which we usually function.

The CAP method attempts to limit this linkage of skills to specific materials by teaching global strategies inductively through exposure to several tasks which involve a common processing component. This method provides the opportunity for students to internalize general principles in ways which are personally meaningful, thus increasing the likelihood that they will apply the strategies to new situations outside of training. Early CAP studies have shown this method to be successful in producing transfer of performance in successive and simultaneous processing (Brailsford, Snart, & Das, 1984; Kaufman, 1978; Krywaniuk, 1974; Spencer, Snart, & Das, 1989).

Although global training may improve performance in cognitive processing, the ultimate purpose of training is to improve academic skills. Historically, a shortcoming of process-based remedial models has been in their inability to produce improvement in academic domains. The CAP model, while similar to other process-based remedial models, also differs in ways which facilitate academic transfer.

Academic Transfer

The CAP shares certain features with many other process-based training models. As mentioned earlier, researchers using such models have experienced little success in terms of obtaining transfer to academic material. For example, psycholinguistic training models, based on assessment instruments such as the Illinois Test of Perceptual Abilities (ITPA) (Kirk, McCarthy, & Kirk, 1968) and the Developmental Test of Visual Perception (DTVP) (Frostig, Maslow, Lever, & Wittlesey, 1964), have been used to improve academic skills through direct remediation of perceptual processes such as auditory and visual reception, association, and integration. Although these methods have been found to increase expressive, visual-motor, and representational abilities (Kavale, 1981, 1982), their usefulness for improving academic skills has received little support. For example, meta-analyses performed on several training studies based on the ITPA (Larsen & Hammill, 1974; Larsen, Parker, & Hammill, 1982), found that the

amount of training necessary to produce even a slight increase in academic achievement (approximately 50 hours) placed serious doubts on the efficacy of this method.

Arter and Jenkins (1979) also reviewed many studies of psycholinguistic training models, including the ITPA and the DTVP, and found little support for the usefulness of these models in improving academic skills. They attributed the limited success of such models to problems of ambiguity concerning definition and assessment of perceptual constructs, as well as the nature of the relationship of these constructs to academic tasks. Further, these authors stated that there is little evidence to support the assumption that these abilities, if they do exist, can be trained, or that such training leads to significant improvements in academic performance.

Although the CAP model can also be viewed as involving direct process training, it differs from perceptual and psycholinguistic training models in two ways. The first difference involves the the ambiguity within psycholinguistic models concerning the nature of the processes being trained and their relationship to academics. The CAP model, unlike psycholinguistic models, is based on empirical evidence as to the existence of the constructs which it attempts to measure and remediate (Luria, 1963), as well as their link to academic skills such as reading (Das & Cummings, 1977; Das, 1984; Kirby & Robinson, 1987; Naglieri, 1989).

The second difference between the CAP and psycholinguistic models involves their respective approaches to process training. Psycholinguistic models attempt to "strengthen" processes in the way one strengthens muscles, through repeated exercise. The problem with this approach is that these processes, if they do exist, may not be amenable to direct training. The CAP does not attempt to train processes directly, but instead promotes the use of global strategies, or thinking styles, through exposure to several tasks which share a common processing component. In this way the student is provided with general principles that can be useful in coping with various academic tasks.

Another popular remedial method which has attempted to produce academic improvement by training general principles is Feuerstein's Instrumental Enrichment (IE) program (Feuerstein, 1979). In this program Feuerstein attempts to modify children's cognitive organization through training with a series of paper and pencil tasks designed to improve deficiencies in the Input, Elaboration, and Output phases of information processing. The purpose of IE is to improve the ability to learn from new experience. According to this approach, cognitive change is produced through Mediated Learning Experience (MLE), in which the instructor assists the student in organizing and structuring his/her thought processes, thus making relevant stimuli more salient and accessible. In this manner, instruction attempts to produce insight and reflection on the purposes of the task. During training the instructor and the student first discuss what information is needed to perform each task and formulate one or more plans for solving the problem. The student then works individually on the task, and the instructor intervenes only to guide the student out of unproductive strategies. After the student has completed the task, the instructor and student again discuss and summarize what the student has learned about strategy use, as well as possible applications of the strategies to academic work.

Research using IE to remediate learning difficulties has produced improvements in the cognitive operations as defined in each of the previously mentioned information processing phases (Feuerstein, 1979; Haywood & Arbitum-Smith, 1981; Weller & Craft, 1983) as well as improvement in immediate problem solving ability (Shayer & Beasley, 1987). However, like the psycholinguistic models, limited transfer to academic areas using IE places doubts on the generalizability of such training.

The IE and CAP models are similar in many ways, both involving inductive training of global strategies. However, there are important differences between the Feuerstein model and the CAP. The first difference concerns the theoretical bases of the two models. Feuerstein's model is very eclectic, drawing from the areas of social

psychology, psychometrics, and Piagetian developmental theory. Learning problems are described as resulting from "cultural deprivation", or a lack of mediated learning experiences in the child's environment (Feuerstein, 1977). While this description is useful in that it shifts the focus away from the student to the environment, no direct measure is provided for the constructs of cultural deprivation or mediated learning experience. The CAP model, however, is derived from an empirically grounded perspective of cognitive processing based on neurological studies. Further, a direct measure of the processing constructs used within the CAP model (simultaneous processing, successive processing, attention, planning) is provided by the CAS. Therefore, the CAP model is derived from a firm empirical and theoretical basis and contains a precise method of operationalizing and measuring the processes it attempts to remediate.

In summary, it has been noted that, while the CAP is similar to other popular types of process training models, it is superior in terms of empirical evidence of the existence of the processes that it attempts to train and their relationship to academics. As a result, the CAP has been successful in producing academic transfer. Training in successive processing has produced significant improvement in word recognition (Kaufman, 1978, Krywaniuk, 1974), instructional reading level (Brailsford et al., 1984), mathematical calculation (Kaufman, 1978) and spelling ability (Spencer, Snart, & Das, 1989).

Although the academic improvements found in the aforementioned studies were statistically significant, further generalization to academic skills was desired. Therefore, development of the CAP model has continued in an attempt to increase academic transfer. The next sections will outline two recent revisions to the model. The first of these revisions is the use of **verbal mediation**, or guidance provided by the instructor concerning the salient features of the tasks. The second revision of the CAP model is the addition of **bridging tasks** to the remedial program. These tasks are

designed to train the same strategies as the global tasks, but focus on the application of these strategies to specific curriculum content. These components have been added to the original method of global strategy training in such a way as to facilitate transfer of global principles to outside of the instructional context, while highlighting the application of these strategies to specific areas of academic difficulty.

Verbal Mediation

The technique of verbal mediation is based on the Vygotsky's (1978) theory that learning is a collaborative activity which is social in origin. According to Vygotsky, the purpose of education is to accelerate the cognitive development of children. This is accomplished through internalization, or the integration of new information into the individual's own cognitive framework. Internalization can occur from within the individual, but is often facilitated by an instructor through mediation. Mediation is assistance provided by the instructor to help the student to focus on the important aspects of material being learned. Language plays an important role in the process of mediation. Language is a system of signs which take on meaning through the course of experience. Through the use of this sign-system as a tool for the organization of thought, the student is able to transform external stimuli into internal codes which are personally meaningful to him/her. For the purpose of instruction, it is important for the student to reflect on the the purpose of the instruction so that he/she may internalize the principles being taught in his/her own manner. This requires the student to take a more active role in the instruction, and therefore promotes student independence and responsibility for learning. Vygotsky's theory, therefore, promotes active discussion between the student and the instructor so that the instructor can verbally guide, or mediate, the student's focus to the important features of the lesson.

Other non-process oriented models have successfully utilized verbal mediation to improve academic skills. In the area of metacognition, for example, the purpose of

instruction is to increase awareness of appropriate strategies and the knowledge of how and when to effectively use these strategies. Metacognitive models have been successful in improving reading comprehension (Alley & Hori, 1981; Paris & Jacobs, 1984) and in producing transfer to situations outside of the instructional context (Palinscar & Brown, 1984). Cognitive behavior training is another method that emphasizes verbal self-monitoring methods such as "talking aloud" during the performance of the task. These techniques have been successfully employed in teaching students to self-monitor their comprehension of text (Short & Ryan, 1984, Wong & Jones, 1982) and have produced increases in reading comprehension.

Verbal mediation has also been incorporated into CAP training in order to increase transfer of processing strategies by requiring the learner to become a more active participant in the learning process. For example, Brailsford et al. (1984) trained learning disabled children on successive and simultaneous processing strategies. They used "talk aloud" procedures, probing by the instructor, and discussion of processing strategies, to assist the children in reflecting on the purpose of the tasks and internalizing the strategies used. These methods produced significant improvement in successive processing, as well as improvement in instructional reading level.

Bridging Tasks

As mentioned earlier, CAP studies have been successful in obtaining transfer of general strategies outside the instructional context, and have produced transfer to academic tasks (Brailsford et al., 1984; Kaufman, 1978; Krywaniuk, 1974). While academic change, as measured in these studies, was statistically significant, increased generalization to academic performance was desired.

A possible reason for limited generalization to academic performance is that the students, while learning the general processing strategies, did not understand how to apply these strategies to specific curriculum content. Several strategy training

programs have advocated process training in the context of curriculum content, with the purpose of decreasing transfer distance to actual academic tasks (Dansereau, 1985; Palinscar & Brown, 1984). While there are problems, as mentioned earlier, in focussing exclusively on strategies related to specific content, several training models have been successful in producing specific transfer to academic tasks using this approach. For example, Palinscar and Brown (1984) used a method of "reciprocal teaching" in which the students were involved in teaching material to each other, with the assistance of the instructor, in a small group setting. Using this method to teach reading comprehension strategies, these authors found significant improvements on standardized tests of comprehension, as well as reported improvements in comprehension in the classroom.

The CAP model has, therefore, incorporated curriculum-based training into remediation, while still maintaining the global strategy training approach. This is accomplished by first training with content-free materials and then moving to content-based training through "bridging tasks" (Das & Conway, in press). These tasks require similar strategies as the global tasks, but apply these strategies to specific academic content. By using both content-free and curriculum-based training the CAP attempts to serve two purposes. First, global training promotes the internalization of general strategies, thus facilitating transfer to situations outside of the instructional context. Second, the use of bridging tasks allows remediation to focus on a particular area of academic deficit and demonstrate how these strategies can be applied to improve that area. These tasks are used in conjunction with verbal mediation, where the student and instructor discuss the strategies used and how they can be applied to academic material.

It should be noted, however, that the training still follows an inductive learning model. In the bridging tasks, like the global tasks, the instructor does not simply provide the strategies for the students to use, but allows them to be inferred through the specific manner in which the material is presented. Therefore, the application of the

processing strategies is also reflected upon and internalized by the student in an inductive manner.

Bridging tasks have been successfully used by Spencer et al. (1989) in a remediation study involving the teaching of spelling using successive instruction. By bridging several successive processing tasks to tasks involving spelling words, this researcher was able to demonstrate significant increases on successive processing tasks as well as spelling performance on the Test of Written Spelling (TWS-2) (Larson & Hammill, 1986).

Application of CAP Model to Reading Difficulties in HPLD Student's

The purpose of the present study was to apply the CAP method to improving decoding skills in HPLD children by training in successive processing strategies and bridging these strategies to decoding. The question posed in the present research was "What effect will CAP training, using global and bridging tasks, have on the successive processing ability, decoding skills, and self-concept of HPLD children?" Three hypotheses were put forth.

1. If CAP global strategy training is successful in encouraging HPLD students to internalize successive processing strategies, improvement should be noted in such strategies on independent cognitive assessments.

2. If CAP bridging tasks are successful in highlighting the application of successive strategies to basic decoding skills, then improvement should be noted in these skills on independent reading assessments.

3. An adjunct hypothesis concerned the self-concept of the students in the study. As mentioned earlier, HPLD children often possess lower self-concept with respect

to academic abilities. Therefore, it was hypothesized that, if CAP training was successful in improving reading ability, then the students may perceive that they have more strategies with which to deal with reading in school, thus improving their perception of their academic abilities, and specifically reading abilities.

Although three hypotheses were put forth, the present study was largely exploratory in nature. This exploratory perspective was adopted in order to address two important issues. The first issue concerned the appropriateness of this remedial model for HPLD children, a group whose needs for specialized remedial instruction are often neglected in school. Previous research has suggested that HPLD children often experience difficulty in basic reading skills (Gunderson et al, 1987) which has been related to weak ability in successive processing (Hansford et al., 1987; Snart et al., 1988). For this reason, the implementation of the CAP remedial program, with primary focus on successive processing strategies as applied to decoding skills, appears to be well suited to the specific needs of such children. Further, since HPLD children typically possess very good verbal-conceptual ability, they may be able to derive a great deal of benefit from a program which encourages verbal mediation and inferential learning in order to promote generalization of strategies.

The second important reason for the exploratory nature of the study was to provide insight into the exact nature of the effects of CAP training, incorporating global and bridging tasks, on reading skills of children experiencing reading difficulties. Previous remedial research (eg. Kaufman, 1978, Krywaniuk, 1974) has used a group design methodology, and therefore has not examined the exact nature of the changes produced in the students. In the present study a case study paradigm was used to provide an in-depth, qualitative examination of reading skills over the course of the intervention, and the nature of any changes that occurred.

The reading difficulties observed in HPLD students were, therefore, used as a model for other children experiencing reading difficulty and deficits in successive processing. As previously noted, the characteristics of HPLD children are not unique to this group. Learning disabled children of average intellectual potential have been noted to display similar deficits in basic academic skills (Ashcroft, 1982; Brophy & Good, 1974), attention and concentration (Krupski, 1986), and successive processing (Cummings & Das, 1977; Das, Kirby, and Jarman, 1979). The difference between the HPLD population and the general LD population lies in the greater discrepancy between strengths and weaknesses found within the HPLD group (Yewchuk, 1984). In the general LD population the previously mentioned deficits may be more difficult to isolate because of below average performance in other areas. The strengths displayed by HPLD children, however, may provide a backdrop upon which areas of weakness may be highlighted, thus making specific processing deficits easier to study. The patterns of cognitive and/or academic deficits found in HPLD children may, therefore, provide insight into the nature of difficulties experienced by other LD children.

CHAPTER II - METHOD

Subjects

Three children were chosen from classes in Edmonton, Alberta. Participation in the study was based on the following criteria:

(a) High overall intellectual ability was determined by a Full Scale IQ equal to or greater than 120 on the Wechsler Intelligence Scale for Children-Revised (WISC-R) (Wechsler, 1974). This was a liberal criterion in comparison to the usual IQ requirement for classification as gifted, which often includes only the top 5% of children, or those scoring at or above 130 on the WISC-R (Davis & Rimm, 1989). However, given the variability between subtest performance that has been noted in HPLD children (eg. Bow, 1987; Fox, 1983; Schiff et al, 1981), a slightly lower level of intellectual potential, coupled with an observation of wide variability in subtest performance, was considered to more closely represent the type of children described in previous research. If WISC-R data were unavailable for the children, a WISC-R was administered.

(b) A deficit in successive processing was determined by a score at or below the 25th percentile on three successive marker tasks of the CAS based on norms provided by Das, Mensink, and Mishra (1987-88).

(c) A deficit in decoding skill was determined by a score at or below 25th percentile (based on age) on the Basic Skills Cluster of the Woodcock Reading Mastery Test-Revised (WRMT-R) (Woodcock, 1987). However, since the words used in the bridging tasks were at a grade 3 level, all students were required to possess word recognition ability of at least grade 3 as measured by the Word Recognition subtest of the WRMT-R.

(d) Certain pre-requisite phonetic abilities, such as single letter or letter combination sound-symbol correspondence, were required for students to benefit from

intervention. Students were, therefore, administered the Roswell-Chall Diagnostic Test of Word Analysis Skills (Roswell & Chall, 1959) to ensure that these skills were present.

(e) Males between the ages of 10-0 and 12-11 years were chosen for the present study. The decision to use males was based on the finding that males, who typically represent approximately 80% of the LD population, possess differences in processing in comparison to female children with learning difficulties (Venzulli, 1987). Further, previous research with HPLD children has suggested that successive processing deficits may be more consistently represented in males (Hansford et al., 1987). The age range was chosen since students at this age would normally have developed the reading skills being taught. The lack of these skills could, therefore, be inferred to represent a reading deficit.

Procedure

Written informed consent for children to participate in the study was obtained from parents. Following parental consent, the study was explained to each student and verbal consent was obtained prior to proceeding. (For a description of parent consent form and description of study to children, see Appendix A.)

A case study approach was used in the present study to provide detailed qualitative and quantitative examination of the reading skill levels and processing abilities of each student. Two types of data were collected and analyzed in order to determine whether intervention was successful in improving performance in successive processing, reading, and academic self-concept. The first type of data included an examination of pre-test and post-test differences on several variables, providing an indication of improvement in performance as well as the nature of the improvement. The second type of data involved an examination of the strategy use and reading performance demonstrated by the children during the intervention. These data provided

a dynamic perspective of change in successive strategy use and reading ability through the course of the intervention.

Pre-Test and Post-Test Assessments

Pre-test and post-test assessments were conducted on measures of cognitive processing (simultaneous and successive processing, attention, and planning), reading (basic skills and comprehension), and academic self-concept. On standardized tests the difference between pre-test and post-test performance was compared to the Standard Error of Measure (SEM) of the instrument. Since an individual's true score on a standardized test falls within two SEM of their observed score 95% of the time, a second score that falls outside this limit can be inferred to represent a real difference from the original score. Therefore, a pre-test/post difference equal to or greater than two SEM was inferred to indicate that real change had occurred. On criterion-based measures, a qualitative comparison of pre-test and post-test performance was conducted to determine whether change in specific skills had occurred over the course of the remediation. Pre/post measures included:

(a) A battery of nine tasks from the Cognitive Assessment System (CAS) was used to determine performance in cognitive processing (simultaneous and successive processing, attention, and planning). CAS norms (Das, Mensink, & Mishra,1987-88) were based on 140 children, ages 10.5 to 12.0 years, from Edmonton, Alberta. Alpha reliability coefficients of CAS tasks ranged from .68 to .86. These norms provided SEMs against which the subjects' scores were compared. A criterion of two SEMs was used to determine whether significant change had occurred. In order to reduce the possibility of practice effect due to the unavailability of equivalent forms, the assessment was presented twice at the pre-test. This procedure increased the students' familiarity with the tasks and provided a baseline of performance so that further improvement could be

attributed to the effects of the intervention. Although this technique has certain drawbacks, it was considered to be the most practically feasible method of ensuring that changes in performance were due to the effects of the intervention rather than practice effects, since the major effect of practice would have been accounted for prior to the intervention. Standard scores were used for graphical presentation of CAS performance so that the relative skill levels between task could be compared. (for a more detailed description of the CAS assessment, see Appendix B)

(b) The Woodcock Reading Mastery Test-Revised (WRMT-R) was used to obtain a standardized measure of reading ability (decoding and comprehension). Norms for the WRMT-R were based on 6089 subjects from various areas of the United States controlled for race, community size, and socio-economic status. Internal consistency reliability, as measured by split-half Spearman-Brown formula, provide a median Full Score reliability of .98, with subtest scores from .87 to .97. Concurrent validity coefficients with Woodcock-Johnson Reading Tests range from .60 to .91. SEMs for subtest and cluster scores were based on Difference scores (Mean=100). Changes between pre-test and post-test Difference scores were compared to the pre-set criterion of two SEM to determine whether significant change in performance had occurred. Equivalent forms of the WRMT-R were used at pre-test and post-test to reduce practice effects.

The Burns-Roe Informal Reading Assessment (IRA) (Burns & Roe, 1980) provided a criterion-based measure of decoding and comprehension skills. The IRA Graded Word Lists (based on McNally and Foresman basal reading series) were used to assess single word recognition, and Graded Passages (based on Spache and Fry Readability formulas) were used to assess word recognition in context, oral comprehension and listening comprehension. Students' performance on each grade level administered was rated as Independent, Instructional, or Frustrational. The highest Instructional ratings obtained on each subtest before and after intervention were

compared in order to determine whether significant change occurred. A qualitative examination of pre-test and post-test performance was also conducted in order to determine the nature of any changes.

Miscue analysis, both in the context of passage and single word reading, was conducted to provide a qualitative interpretation of the students' decoding ability before and after intervention. Miscue analyses on all grade levels administered were conducted using methods described by Burns and Roe (1980), dividing miscues into substitutions, mispronunciations, omissions, repetitions, insertions, reversals, and refusals. A more in-depth analysis was then conducted on a subset of twenty miscues from graded passages in which the students performed at instructional level. Twenty miscues were felt to provide an adequate indication of the types of reading strategies used by the students at instructional level. These miscues were further examined according to number and type of corrections made and graphic similarity of text words to miscues based on criteria established by Malicky (1985). The miscues were also analyzed in terms of meaningfulness according to criteria established by Goodman and Burke (1972). (for a description of miscue analysis criteria and sample analysis, refer to Appendix C)

Oral comprehension level was determined by students' performance on comprehension questions which accompanied Graded Passages of the IRA. Oral comprehension was further examined in terms of performance on questions concerning main idea, sequencing, detail, cause and effect, inference, and vocabulary, to obtain a qualitative measure of the students' comprehension skills. A measure of listening comprehension was also adapted from the IRA by reading the graded passages to the student and then asking questions in the same manner as oral reading comprehension tests. Following the suggestions of Fox (1983), a comparison of performance in oral and listening comprehension was used to provide an indication of whether observed comprehension difficulties were specific to the act of reading or were indicative of a more general language deficit.

(c) Self-concept with respect to academic performance was assessed using the Perception of Academic Abilities Scale for Students (PASS) (Boersma & Chapman, 1988). The Pass is a seventy item yes/no questionnaire relating to student's feelings about their academic abilities, and their satisfaction with school. The number of positive responses for each subscale are compared to a normative criteria to determine the student's relative perception of his/her abilities (For a description of scoring criteria for the PASS see Appendix D.). Norms for this test were based on 831 children from grades 3 to 6 attending 9 schools in Idaho, Washington, and Oregon, and representing a full range of socio-economic status, achievement levels, and races. Internal consistency coefficients, obtained by Cronbach's alpha, are .91 for Full Scale score, and range from .68 to .85 for subtests. The PASS Full Scale score and the Intellectual and School Status subscale of the Piers-Harris Children's Self-Concept Scale correlated .74. Differences between pre-test and post-test measures on this test provided a measure of change in the child's self-confidence with respect to his/her academic abilities, and specifically his/her reading skills. It was inferred that, if the student perceived that he/she had a greater range of strategies to use in reading, and an empowerment to select appropriate strategies, academic self-concept would improve.

Dynamic Assessment

Dynamic assessments were conducted to provide a measure of change in the students' performance throughout the course of the intervention. The purposes of these assessments were to determine what types of strategies were used by the students, as well as to provide a longitudinal measure of changes in processing and reading skill during the intervention. This information was provided by a qualitative impression of performance during intervention, and probes of decoding ability.

Qualitative Impression of Performance

During remediation, records were kept of performance on all global and bridging tasks in terms of percentage of correct responses in each session and the types of strategies observed and reported by students during each session. This provided two sources of data. First, performance in global and bridging task were examined to determine whether the students were becoming more proficient in their strategy use throughout the remediation. Second, these data provided an indication of what type of strategies the students employed in each of the tasks, as well as the types of tasks in which they excelled, or which they found difficult.

Decoding Probes

Three times throughout the remediation, decoding probes were conducted to provide a measure of improvement and transfer of skills to decoding. To measure direct effect of training on decoding skills, a pre-test and post-test was conducted involving speed and accuracy of reading a list of 30 words randomly chosen from the pool of words used in the remediation. Ratio scores for these probes were calculated by dividing the time taken to read all of the words by the number of words correctly read, resulting in a score in seconds/correct word. Three times during the remediation a pre-test list of words were given (probes 1, 3, and 5). These words were then used in the bridging tasks within the next three remedial sessions. After three sessions the probes were given again. Since the words in all probes, as in the remediation tasks, were already known, this test was not susceptible to practice effects due to repeated exposure to the words. Instead, improvement noted on these probes provided an indication of direct improvement in decoding skill with words which were used in training during these sessions. A second set of probes (probes 2, 4, and 6) was given at the same time as the post-test of probes 1, 3, and 5 to provide an indication of transfer of decoding skills to new material. These probes included lists of 30 different words at the same phonetic

complexity level as the previous probes, but which were not used in the remediation. Therefore, if the scores on probes 2, 4, and 6 approximated post-test performance on probes 1, 3, and 5, it could be inferred that decoding skills transferred to words that were not used in the intervention.

Intervention

Training consisted of approximately 15 hours of individualized remedial intervention involving 6 global and corresponding bridging tasks. Two or three training sessions were conducted per week. Each session was approximately one hour in duration, and involved training on two global and two corresponding bridging tasks. The tasks were presented in the following order: Related Memory Set, Joining Shapes, Transportation Matrices, Connecting Letters, Serial Recall, Window Sequencing. This order of presentation was used for the purpose of maximizing variety of materials and maintaining the student's attention to task. (For a detailed description of CAP global and bridging tasks, see Appendix E.)

Global Training

Global strategy training was conducted using 6 global tasks, which were designed to focus primarily on successive processing. Each task had three difficulty levels. Only one difficulty level was presented within a single session with each task. The number of sessions conducted at a specific difficulty level was determined by the performance of the student. An accuracy level equal to or greater than 80% was required on each task in order for the student to move to the next level of difficulty in the next session conducted with that task. If the accuracy level fell below 80%, the next session was conducted at the same difficulty level. Once the student had performed to criterion at all levels of difficulty on each task, the intervention was discontinued.

Bridging Training

A bridging task accompanied each global task, and was similar to the global task in form and presentation. The focus of the bridging tasks was on the application of the successive strategies to decoding. The pool of grade 3 level words was chosen for these tasks as measured by the EDL Core Vocabulary (Taylor, Frackenpohl, White, Nieroda, Browning, & Birsner, 1979). This level of word difficulty was chosen to ensure that the words would be known to the students, thus allowing the children to focus primarily on applying the strategy instead of learning the words. Within this pool the words were subdivided into three levels of phonetic difficulty as measured by the Roswell Chall Diagnostic Test of Word Analysis Skills (Roswell & Chall, 1959). Each level of difficulty was paired with the corresponding level of difficulty on the global task. The same 80% criterion for progressing on to subsequent difficulty levels was used in the bridging tasks. The characteristics of words at each difficulty level were as follows:

Difficulty Level 1. - Single syllable words containing short vowels, single consonants, and consonant blends.
Difficulty Level 2. - Words containing the previous characteristics plus long vowels, vowel blends, and silent "e".
Difficulty Level 3. - Words containing the previous characteristics plus multiple syllables.

Within each difficulty level the words were further subdivided into three groups based on word length. In Difficulty level 1, words containing three, four, and five letters were presented. Difficulty level 2 contained four, five, and six letter words. In Difficulty level 3, five, six, and seven letter words were used. The purpose of these divisions was to provide a gradual increase in difficulty within a single session.

Therefore, while all words were at a grade 3 level of difficulty, they increased in difficulty both within a single session and between sessions with each task.

Verbal Mediation

Verbal mediation throughout the intervention involved explicit directions for each task as well as a discussion of strategies required to perform the tasks and their application to reading. The student was required to verbalize during the performance of tasks, and was assisted in doing so by the instructor. Students' performance on each task was scored on a two-point scoring system, which delineated the amount of assistance which was provided. Two points were awarded if the student responded correctly after the initial instructions and no further assistance from the instructor. If the student failed to correctly respond upon his first attempt, the instructor provided a prompt to the student as to strategies which may assist him in responding correctly. The instructor did not provide exact steps on how to perform the task. However, hints were provided as to how the tasks may be successfully completed, thus allowing the student to develop his own strategies. A correct response after such a prompt was awarded one point. If the student still did not provide a correct response, the instructor provided further assistance or demonstrated the correct response to the student, and 0 points were awarded. After correct responses the instructor asked the student how he performed the task, and if he used any particular strategies that he was aware of. After the completion of each task, the student and instructor summarized and discussed the strategies used, and how each bridging task was related to the global task and to reading in school. (for a description of the types of prompting and verbal mediation provided within each task, see Appendix E)

CHAPTER III - RESULTS

Brian

Background Information

At the time of initial assessment Brian was eleven years and five months of age. Brian's mother reported that he was born two weeks prematurely and suffered from jaundice and respiratory problems. She reported that his motor development was normal, and his speech seemed to develop very early. Brian's mother also reported that his reading readiness skills were also early in developing. By the time he reached kindergarten he knew the alphabet and how to spell some words.

Brian appeared to regress, however, in his academic and motor ability throughout his early school years He was easily frustrated, and lacked patience to sit and work through material. In kindergarten he was diagnosed as hyperactive and was prescribed medication (Ritalin) to improve this condition. Medication seemed to assist him somewhat in staying on task, but he still required assistance in order to complete work. Brian was enrolled in a Ukrainian Bilingual program in grades 1 and 2, but because he was having difficulties in core subjects, he was placed into a regular program in grade 3. He received resource room assistance in Language Arts and Arithmetic in grades 3 and 4.

At the time of intervention Brian was attending a regular grade six class, and was not receiving resource room assistance. Brian's teacher reported that he was very distractible in class, and had difficulty organizing himself for work. She stated that his performance was generally low in all areas, but varied considerably from day to day. She said that Brian was easily frustrated when he could not perform a task. Brian's mother reported that he enjoyed Science and Physical Education. He had great

difficulties, however, in Arithmetic, especially in basic computation. In reading Brian also experienced difficulties, especially in visual tracking.

Brian's teacher also noted that, although Brian appeared very capable, he often failed to hand in written assignments. She reported that his reluctance to attempt assignments appeared to be due to a fear of not performing to the expectations of others. For example, Brian was once very hesitant to hand in a Language Arts assignment. Brian's teacher felt that his reluctance was due to the fact that he had done very well on the previous assignment, and was afraid that the second assignment would not "measure up" to the precedent he had set.

In January, 1987, Brian was referred for psychoeducational assessment because of problems in visual-motor integration as well as attentional difficulties. Administration of a Wechsler Intelligence Scale for Children - Revised (WISC-R) placed his Full Scale IQ score at 125, which fell within the Superior range. However, he demonstrated a great deal of variability in performance between subtests. On the Verbal Scale Brian's score was 118, placing him within the High Average range. On the Performance scale Brian's score of 128 was within the Superior range. Brian's WISC-R subtest profile is displayed in Table 1.

Brian's pattern of subtest scores is similar to patterns found to be common among HPLD children. He obtained Superior to Very Superior scores on Similarities, Comprehension, Picture Arrangement, and Object Assembly. Lower scores, falling within the Average to Low Average range, were obtained on subtests such as Information, Coding, Picture Completion, and Digit Span. During this assessment Brian was also administered the Beery Developmental Test of Visual-Motor Integration. This test indicated a delay in visual-motor integration of approximately one and one half years.

Table 1

Brian - WISC-R Subtest Profile

Verbal Subtests	Scaled Score	Performance Subtests	Scaled Score
Information	11	Picture Completion	11
Similarities	15	Picture Arrangement	17
Arithmetic	12	Block Design	12
Vocabulary	13	Object Assembly	18
Comprehension	14	Coding	11
(Digit Span)	7		

Verbal Score - 118

Performance Score - 128

Full Scale Score - 125

Clinical Impressions

Brian initially presented as a friendly, talkative child. He was very eager to share experiences with the instructor. In school subjects, Brian reported that he enjoyed Science, and felt that Arithmetic was "average". Brian said that he enjoyed reading, and read frequently at school and home. He stated that in studying he either skimmed the material or read it several times. He also stated that, when encountering unfamiliar words, he tried to sound them out, then used the dictionary, then asked his mother to help him.

Throughout the intervention, Brian's attention to task was usually adequate, but appeared to vary a great deal. At times he appeared eager to leave, and often asked when the session would be finished. He occasionally appeared to be very bored, yawning and fidgeting frequently. During initial assessments Brian's reading frequently seemed impulsive. He read single words and passages very quickly, and many of his mistakes were nonsense words, indicating that he was not monitoring his reading for meaning. He also frequently attempted to determine words from their overall configuration instead of closely examining the actual letter patterns within the words. On the Roswell-Chall Diagnostic Test of Word Analysis Skills Brian had some difficulty with single consonants, often naming them instead of providing their sounds. Upon probing, however, it was discovered that he did know the sounds. He had no difficulty with long or short vowels, single syllable words, or multisyllable words.

Pre-Test/Post-Test Performance

Cognitive Processing

A some variability was noted in Brian's performance on CAS tasks; his scores fluctuating considerably from administration to administration. While this pattern of performance is not uncommon when measuring a variable on a single subject over

multiple occasions, some of these variations approached significance. This variability may indicate, therefore, that other factors, such as motivation and attention, contributed to his CAS performance. For the purposes of pre-test, post-test comparison, the higher of his pre-test scores was considered to be the most accurate estimate of Brian's abilities. Although raw scores on subtests were used to calculate SEMs and to determine whether changes in performance were significant, Brian's results were displayed graphically in Standard Scores (Mean-100, SD=15) so that comparisons between subtests could be made.

Successive processing. Brian's pre-test and post-test performance in successive processing is displayed in Figure 1. A significant increase was noted in Speech Rate (2.35 SEM), indicating improvement in fluency of sequential word analysis. A trend toward improvement was also found in Naming Time (.60 SEM), and in Successive Word Recall (.84 SEM). This consistent pattern of increases suggested that an improvement occurred in successive processing, especially with respect to word analysis skills.

Simultaneous processing. Brian's pre-test and post-test performance in simultaneous processing is displayed in Figure 2. In Figure Memory a decrease was noted in Brian's performance of 1.54 SEM. This decrease approached significance, suggesting a decrease in spatial memory and discrimination. Inconsistency was noted, however, in Brian's performance on this task. His standard score increased from 84 to 100 between first and second administration of the pre-test, then decreased to 89 at post-test. This pattern of performance indicated that other factors, such as attention or motivation, may also have contributed to Brian's performance. This notion was supported by observations of distraction during the intervention, such as engaging in irrelevant conversation during tasks, looking about the room, and frequently getting out of seat. In Simultaneous Verbal no normative data were available. An increase was

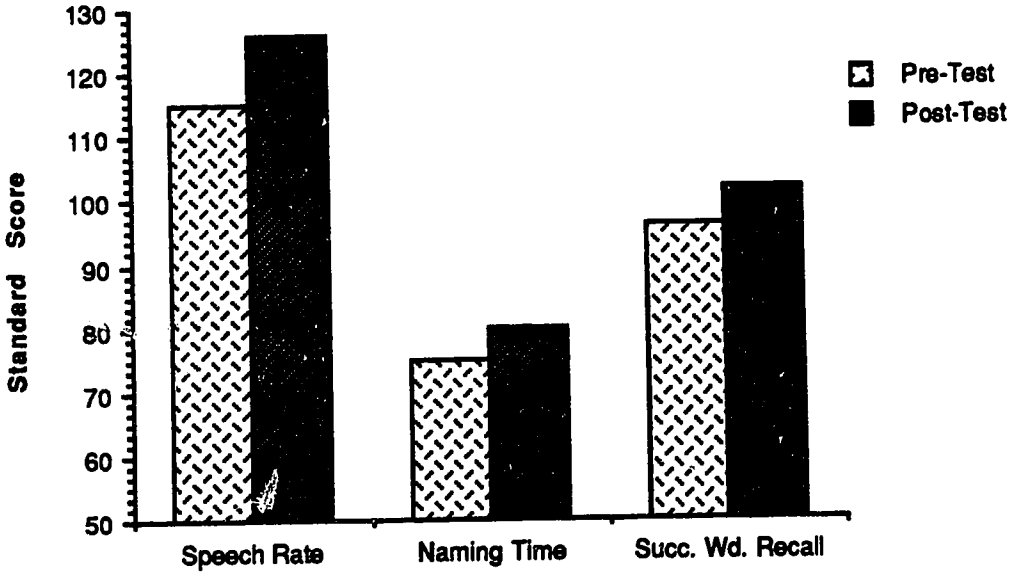

Figure 1. Brian - Pre-test and post-test standard scores on CAS successive tasks.

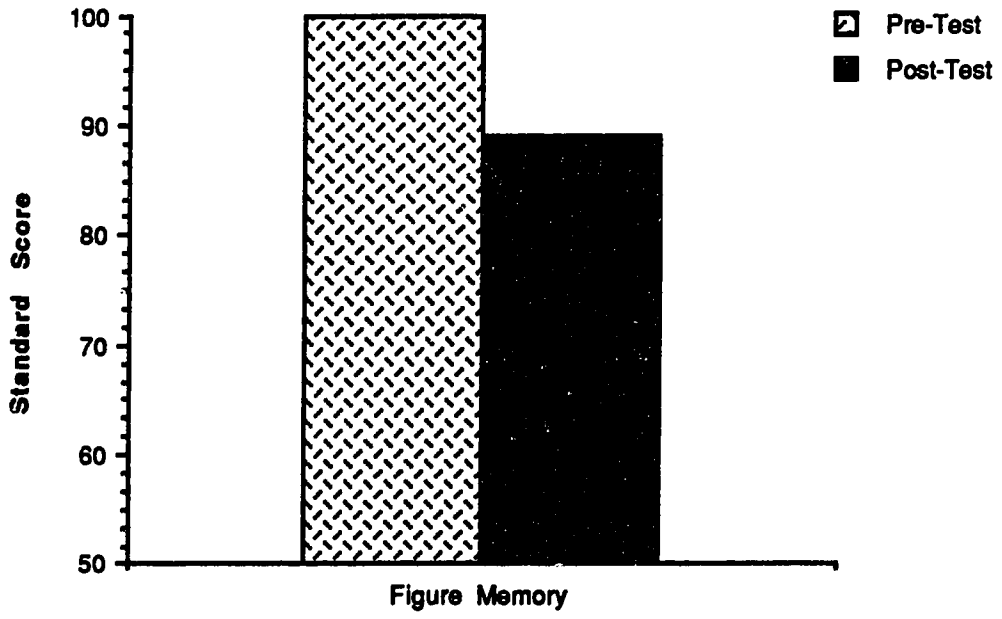

Figure 2. Brian - Pre-test and post-test standard scores on CAS simultaneous tasks.

noted, however, in the number of seconds per correct response, indicating a decrease in performance. Fluctuations were also noted, however, in Brian's performance on this task, his score in seconds/correct response decreasing from 7.35 on first pre-test to 5.06 on second pre-test, then increasing again to 7.88 on post test. These observations again indicated that attentional or motivational factors may have influenced his performance. Given these inconsistencies in performance, it was inferred that no improvement occurred in simultaneous processing.

Attention. Brian's pre-test and post-test performance in attention is displayed in Figure 3. Two selective attention tasks were administered. The first task was Selective Attention Expressive (Stroop task). Because no reliability coefficients were available for this task, SEM could not be calculated. Therefore, the difference between pre and post test Standard Scores (Mean=100, SD=15) was examined, and a difference of two SD was considered to be significant. According to this criterion, no significant changes occurred. However, slight improvements were noted in Word Naming (.87 SD) and Word/Color Naming (.93 SD) indicating a trend towards improvement. The second selective attention task administered was Selective Attention Receptive (Posner task). A decrease in performance was found in Physical Match which approached significance (1.42 SEM). Again, fluctuations were noted in Brian's performance on this task, his Standard score increasing from 103 to 107, then falling to 99 at post-test. This pattern of performance suggested variability in the ability to selectively attend to letter configuration. Slight improvement was also noted in Name Match (.83 SEM).

In summary, results from attention tasks indicate that no significant improvement occurred in selective attention over the course of the intervention. Further, inconsistencies in performance suggested that Brian's selective attention abilities may not have been consistent over time, and that difficulties in maintaining attention may have affected Brian's performance. These indications of attentional

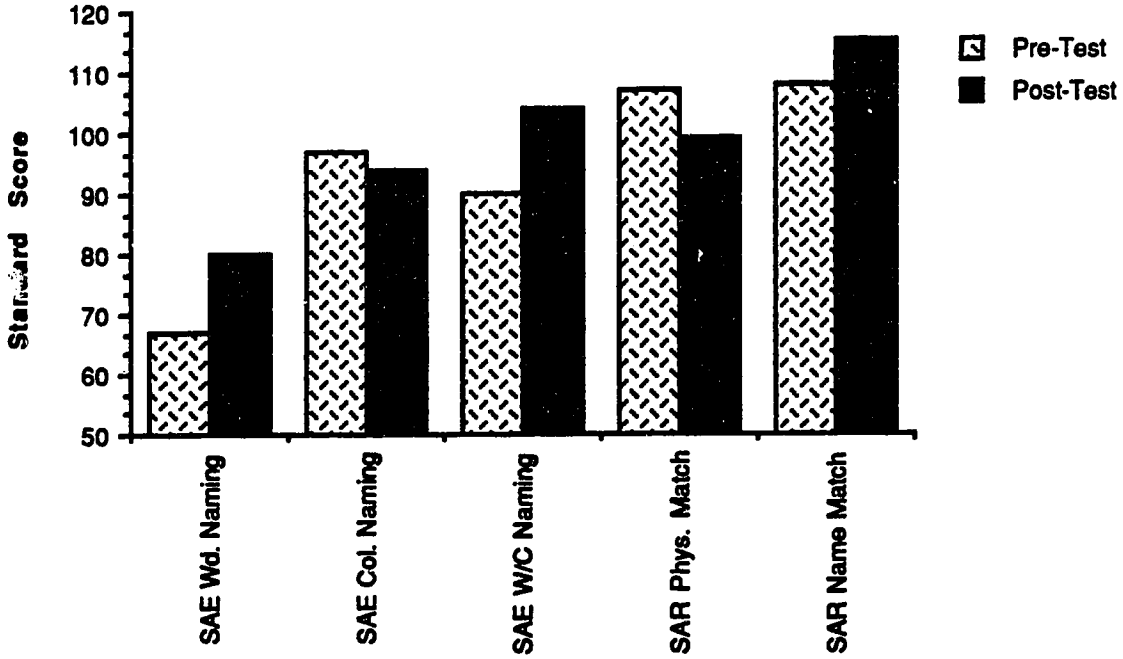

Figure 3. Brian - Pre-test and post-test standard scores on CAS attention tasks.

problems were consistent with behavioral observations during the intervention as well as reports provided by teacher and mother of attentional difficulties.

Planning. Brian's pre-test and post-test performance in planning is displayed in Figure 4. In Planned Connections, slight improvement was found (.77 SEM). No improvement was found in Crack the Code, where Brian's score remained virtually unchanged before and after intervention. It was inferred, therefore, that no improvement occurred in planning ability.

In summary, the only significant change noted in Brian's CAS performance occurred in Speech Rate. Trends toward improvement were also noted on two other successive processing tasks, Naming Time and Successive Word Recall. This consistent trend towards improvement on successive processing tasks contrasted with the lack of improvement noted in simultaneous processing, attention, or planning. It was inferred from these results that the intervention contributed to specific improvements in successive processing.

Fluctuations in scores were noted, however, in several successive, simultaneous, and attention tasks. This variability in performance is not uncommon when measuring behavioral performance of a single subject over multiple occasions. However, the differences noted on some of these tasks approached significance, suggesting that other factors, such as attention and motivation, may have contributed to Brian's performance. The notion of attentional difficulties was supported by behavioral observations and background information.

Reading

Woodcock Reading Mastery Test-Revised. Brian's pre-test and post-test performance on the WRMT-R is displayed in Figure 5. A comparison of Brian's subtest profiles indicated relative consistency in his reading ability, with performance in all

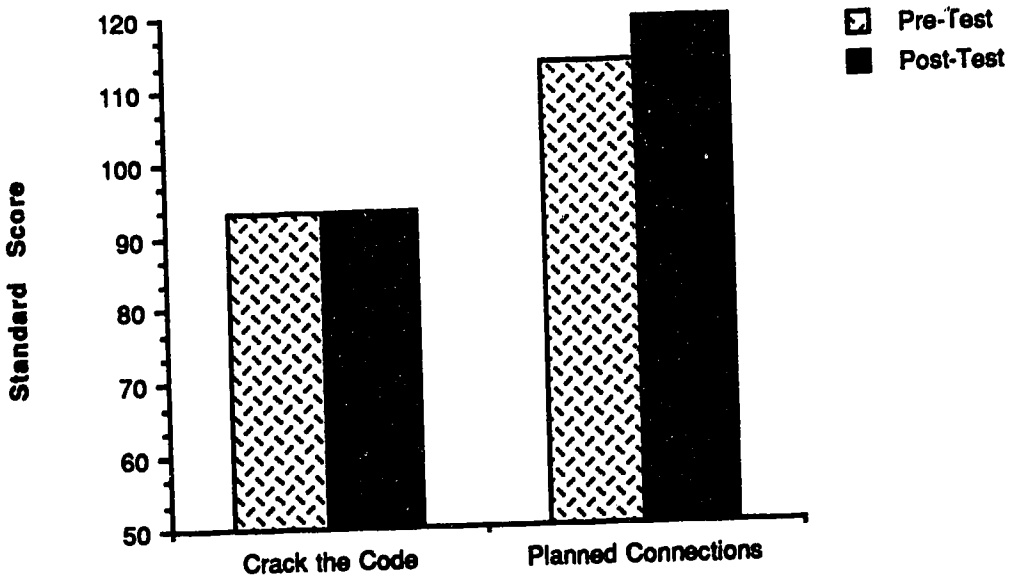

Figure 4. Brian - Pre-test and post-test standard scores on CAS planning tasks.

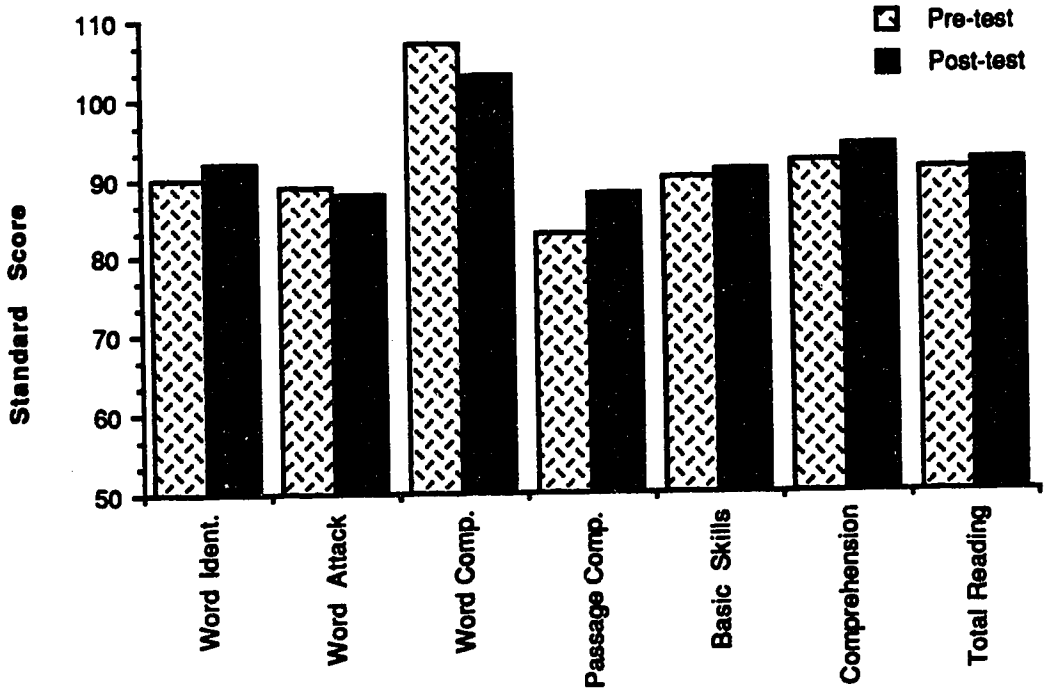

Figure 5 - Brian - Pre-test and post-test standard scores on WRMT-R

subtests being relatively equivalent. One exception was noted in Word Comprehension, which was substantially superior to the other subtests. Brian's Total Reading score increased by 1 SEM from pre-test to post-test. His Basic Skills Cluster score increased slightly (.67 SEM), as did his Comprehension Cluster score (.50 SEM).

In basic skills, a slight increase was noted in Brian's Word Identification score (.75 SEM) as well as a very slight decrease in his performance in Word Attack (.25 SEM). This relatively consistent performance suggested that no change occurred in basic reading skills. Error analysis of Brian's Word Attack subtest revealed a decrease in errors involving vowels and vowel blends from 11 to 6. This analysis suggested that, although no significant improvement was noted in word attack skills, some improvement may have occurred in decoding medial vowels and vowel blends.

In comprehension, Brian's Word Comprehension score decreased by 1.0 SEM, while his Passage Comprehension increased by 1.0 SEM. These results also indicated consistent performance between pre-test and post-test. It was inferred, therefore, that no change occurred in Brian's comprehension skills.

In summary, results on the WRMT-R indicated that no significant improvements occurred in basic reading skills or comprehension. Slight increases were noted, however, in all reading cluster scores. This pattern of results indicated a general trend towards improvement, although such improvement may have been due to chance factors.

Burns and Roe Informal Reading Assessment. IRA assessment included single word recognition and miscue analysis on Graded Word Lists, as well as assessment of word recognition in context, oral comprehension, and listening comprehension using Graded Passages.

Brian's pre-test and post-test performance on Graded Word Lists is displayed in Table 2. Brian's performance in word recognition remained similar from pre-test to post-test. He obtained independent ratings at grade levels 2 and 3, and a Frustration

Table 2

Brian - Graded Word Lists

Pre-Test

Grade	Score	Level
Level 2	20/20	Independent
Level 3	20/20	Independent
Level 4	14/20	Frustration

Post-Test

Grade	Score	Level
Level 2	20/20	Independent
Level 3	19/20	Independent
Level 4	13/20	Frustration

rating at grade 4 on both pre-test and post-test administrations. Miscues observed at pre-test and post-test (See Table 3.) were also similar in number and kind. Brian obtained several substitution errors and a few mispronunciation errors, usually involving the middle or end of words. Brian's strategies in reading single words appeared to involve brief [illegible] the total configuration of the word in a holistic manner. If he did not recognize a word, he would state the closest word that he knew with a similar configuration.

In Graded Passages, Brian's pre-test readings were not taped, and, therefore, appropriate miscue analysis could not be obtained for pre-test performance. Miscue analysis was conducted, however, on Brian's post-test performance, and is displayed in Table 4. The majority of miscues were substitutions, usually involving the mispronunciation of middle or endings of words. Several omissions were also noted, and usually involved prepositions such as "the", or "a". These omissions may have been an attempt to leave out unnecessary words and read the passage more quickly. Several mispronunciations were noted, also involving word middles and endings. Several repetitions were also found, often involving a phrase that surrounded an unknown word. These miscues appeared to be an attempt to use the context of the phrase to determine the meaning of words. Insertions were noted, and seemed to involve an attempt to make sense of passages by strategically adding words.

A sample of Brian's post-test miscues was further examined in terms of number and type of corrections made, the degree of graphic similarity between text words and miscues, and the meaningfulness of miscues. Of twenty miscues analyzed, two were corrected, and corrections appeared to be based on graphics. Brian demonstrated a relatively equal number of miscues which were highly graphically similar (28%) and partially graphically similar (33%) to text words. Few of Brian's miscues were of low graphic similarity to text words (11%). These results indicate that Brian occasionally used graphics to determine words, and often corrected miscues based on graphics.

Table 3.

Brian - Miscue Analysis - Graded Word Lists.

Pre-Test

Grade	Mis.	Sub.	Ref.	Ins.	Om.	Rep.	Rev.	Total
Level 2	0	0	0	0	0	0	0	0
Level 3	0	0	0	0	0	0	0	0
Level 4	1	5	0	0	0	0	0	6
Total	1	5	0	0	0	0	0	6

Post-Test

Grade	Mis.	Sub.	Ref.	Ins.	Om.	Rep.	Rev.	Total
Level 2	0	0	0	0	0	0	0	0
Level 3	0	1	0	0	0	0	0	1
Level 4	1	5	1	0	0	0	0	7
Total	1	6	1	0	0	0	0	8

Mis. = Mispronunciation

Sub. = Substitution

Ref. = Refusal

Ins. = Insertion

Om. = Omission

Rep. = Repetition

Rev. = Reversal

Table 4.

Miscue Analysis-Graded Passages

Post-Test

Grade	Mis.	Sub.	Ref.	Ins.	Om.	Rep.	Rev.	Total
Level 3	2	6	0	1	3	5	0	17
Level 4	1	2	0	0	4	2	0	9
Level 5	3	6	0	2	2	1	1	15
Level 6	0	6	0	0	3	1	1	11
Level 7	1	16	0	4	5	3	0	29
Level 8	10	21	0	3	7	0	0	41
Level 9	3	23	0	0	3	2	0	31
Level 10	2	26	0	3	7	8	0	46
Total	22	106	0	13	34	22	2	199

Brian's miscues were equally divided between high meaningfulness (33%), partial meaningfulness (28%), and low meaningfulness (33%). These results indicated that Brian used his background knowledge to some extent to assist in word identification during oral reading, but had some difficulty monitoring his reading for meaning.

In oral comprehension, it was noted that Brian's instructional grade level surpassed his current grade placement, indicating good abilities in this area. The number and type of comprehension errors made by Brian at pre-test and post-test is displayed in Table 5. Brian's highest instructional level increased from grade 7 at pre-test to grade 9 at post-test. However, a great deal of inconsistency was noted in Brian's performance. For example, on both pre-test and post-test Brian obtained a Frustration rating at the grade 8 level. At pre-test administration was discontinued at this point. On post-test, however, administration was continued, and Brian was able to obtain another instructional rating at grade 9 before obtaining Frustration again at grade 10. Other evidence of inconsistency was provided by the pre-test observation that Brian obtained instructional ratings on grades 4 and 5, but then obtained independent ratings at levels 6 and 7. These inconsistencies suggest that other factors, such as attention and motivation, may have contributed to Brian's performance. Increases in percentage of errors were also noted in Main Idea, Sequencing, and Cause and Effect. It was inferred, therefore, that no substantial improvement occurred in Brian's oral comprehension.

The number and type of Brian's errors in listening comprehension are displayed in Table 6. On this subtest Brian's highest instructional rating increased from grade 6 to grade 9. An examination of Brian's performance indicated much greater consistency in listening comprehension in comparison to oral comprehension. At pre-test Brian obtained an independent rating at grade three, followed by instructional ratings on grades

Table 5

Brian - Oral Comprehension - Percentage of Errors

Pre-Test

Grade	M.I.	Det.	Seq.	C./E.	Inf.	Voc.	Total	Level
Level 3	0	0	0	0	0	0	0	Indep.
Level 4	0	0	0	100	0	100	40	Inst.
Level 5	0	0	0	0	25	0	30	Inst.
Level 6	0	75	0	0	0	0	10	Indep.
Level 7	0	75	0	0	0	0	10	Indep.
Level 8	0	100	100	0	50	100	70	Frust.
Total	0	22	29	14	38	31		

Post-Test

Grade	M.I.	Det.	Seq.	C./E.	Inf.	Voc.	Total	Level
Level 3	0	0	0	0	50	0	10	Indep.
Level 4	100	0	0	0	0	0	10	Indep.
Level 5	100	0	100	0	100	50	40	Inst.
Level 6	100	0	0	33	50	0	20	Inst.
Level 7	0	0	100	0	50	0	20	Inst
Level 8	67	NA	0	0	75	0	50	Frust.
Level 9	0	20	NA	50	100	50	40	Inst.
Level 10	0	40	100	67	100	50	50	Frust.
Total	38	15	43	27	50	35		

M.I = Main Idea, Det. = Detail, Seq. = Sequence, C./E. = Cause and Effect, Inf. = Inference, Voc. = Vocabulary

Table 6

Brian - Listening Comprehension - Percentage of Errors

Pre-Test

Grade	M.I.	Det.	Seq.	C./E.	Inf.	Voc.	Total	Level
Level 3	0	0	0	0	0	0	0	Indep.
Level 4	0	25	0	0	100	0	30	Inst.
Level 5	100	0	50	0	50	0	30	Inst.
Level 6	0	33	100	0	0	33	30	Inst.
Level 7	100	40	0	0	100	50	60	Frust.
Level 8	100	50	100	100	50	50	70	Frust.
Total	50	29	50	14	50	21		

Post-Test

Grade	M.I.	Det.	Seq.	C./E.	Inf.	Voc.	Total	Level
Level 4	0	20	0	100	0	0	10	Indep.
Level 5	100	0	NA	0	0	100	30	Inst.
Level 6	0	50	0	100	33	0	20	Inst.
Level 7	100	0	100	0	100	0	40	Inst.
Level 8	100	33	NA	0	0	50	40	Inst.
Level 9	0	67	100	100	0	50	40	Inst.
Level 10	100	40	NA	100	100	100	70	Frust.
Total	57	30	50	50	29	47		

4 through 6. He then received Frustrational ratings at grades 7 and 8, suggesting that this level was a true Frustration level and not simply an artifact of attentional differences. At post-test Brian's rating at grade 4 improved from Instructional to Independent. He then continued to obtain Instructional ratings until grade 9. This evidence suggested that the differences found between pre-test and post-test on this subtest represented actual change in ability, indicating a substantial improvement in Brian's listening comprehension.

Perception of Academic Abilities.

Brian's pre-test and post-test performance on the PASS is displayed in Table 7. Brian's Full Scale score remained within the "weak" range, and a slight decrease in this score was noted. Most of Brian's subtest scores remained very similar from pre-test to post-test. However, some subscales revealed significant differences. In Reading/ Spelling, Brian's score decreased from the "average" range to the "weak" range. A decrease was also noted in Brian's School Satisfaction, which fell from "average" to "below average". An increase was noted in Confidence, although Brian's score remained within the "average" range.

The decreases noted in Brian's PASS subtest scores indicate that his satisfaction with school as a whole, and in particular his perception of his reading and spelling abilities, decreased over the course of the intervention. Given that the intervention took place near the end of the school year, and that the post-testing was conducted very late in the year, these results may have been a reflection of Brian's increasing dissatisfaction and frustration with school at that point. This hypothesis was supported by reports from Brian's teacher of decreasing quality of performance in class, as well as behavioral observations of increasing distractibility during the intervention. It was inferred, therefore, that Brian's dissatisfaction with school resulted in a decrease in his perception of his academic abilities.

Table 7

Brian - Performance on Perception of Abilities Scale for Students

Subscale	Pre-Test	Post-Test
General Ability	3 weak	3 weak
Arithmetic	5 weak	5 weak
Reading/ Spelling	8 average	5 weak
Penmanship/ Neatness	4 weak	4 weak
School Satisfaction	7 average	5 below avg.
Confidence	3 average	5 average
Full Scale	30 weak	27 weak

Dynamic Assessment

Decoding Probes

Brian's performance on decoding probes is displayed in Figure 6. All words used in probes, as in the intervention, were known. Therefore, any changes in performance should not have been due to practice effect, but instead reflected actual change in decoding ability. Probes 1, 3, and 5 were composed of words which were used in the intervention at each difficulty level. The difference between first and second administration of these probes indicated improvement due to direct training within the context of the intervention. Probes 2, 4, and 6 were composed of words of the same complexity as probes 1, 3, and 5 respectively, but which were not used in the intervention. Brian's scores on these probes were compared to his post-test scores on 1, 3, and, 5 to determine whether generalization of training occurred. Brian's consistent decrease in time/correct word in pre and post tests of probes 1, 3, and 5 indicated that training did have a direct benefit for reading words that were used in the intervention. It was noted, however, that the magnitude of Brian's improvement increased from probe 1 to probe 5. This difference may have been due to a ceiling effect on Brian's performance. Since it is likely that Brian was most competent with the less complex words (probes 1, 3), it may not have been possible for his performance on these probes to improve further. With more complex words (probe 5) Brian may not have been as competent. Therefore, greater improvement may have been possible before reaching such a ceiling, resulting in a greater magnitude of improvement on this probe.

Brian's performance on probes 2, 4, and 6 indicated that training did not generalize to words outside of the intervention. Evidence for this inference was provided by the observation that Brian's performance on these probes was substantially inferior to probes 1, 3, and 5. However, some improvement was noted in performance from probe 2 to probe 6, suggesting possible improvement in decoding. In general, however,

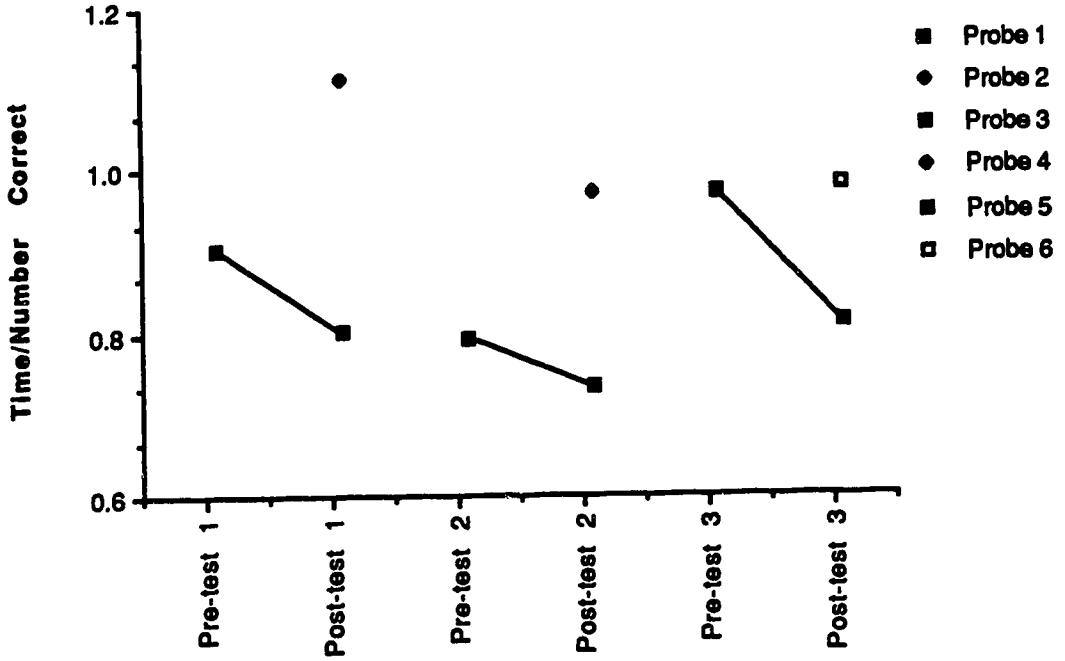

Figure 6. Brian - Decoding probe performance.

it appears that the training contributed to improvement in decoding facility for words that were used in the intervention, but that this training did not generalize to words that were not used in the intervention.

Intervention - Qualitative Impressions

Brian performed very well throughout the intervention, which involved approximately 15 hours of individual intervention within 6 weeks. On global tasks strategies observed included scanning, rehearsal, using background information, and categorizing. During bridging tasks strategies included sounding, sound blending, spelling aloud, and predicting. Brian appeared to have some difficulties holding letters in short-term memory and synthesizing them to form words. He also had difficulties in trying alternative soundings for words. He would often choose a particular sound combination and then would not attempt alternatives.

Related Memory Set. Brian performed very well on the global portion of this task., achieving flawless performance on all levels. On level one he used patterns, colors, and shapes to match the fronts to the backs of the animals. On level two he also used background information (animals he had seen before). On level three similar strategies were used.

Brian also did well on the bridging portion of this task. On level one he used sounding out and background information. He sometimes responded rather impulsively, providing an incorrect response. He would usually respond correctly, however, upon the second attempt. On level two Brian used sounding and checking alternatives. He had a great deal of difficulty with the first words, and appeared not to be putting forth maximum effort. After some encouragement his performance improved greatly. He did not meet criterion, however, and had to repeat the same difficulty level upon the next session. On the next session his performance was greatly improved. He used scanning

and sounding. On level three Brian performed very well, using sounding and scanning alternatives. In his sounding he would often find a smaller word that he knew within the larger word. He would then use this word as a root, and add on other parts to attempt to determine the word. He would occasionally continue to try one sounding, however, and would not attempt alternatives.

Joining Shapes. Brian did well on all levels of the global portion of this task. On levels one and two he easily followed the rules and instructions. On level three he repeated the instructions under his breath, and also reported that he repeated them "in his head". He often hesitated before following the third instruction, which appeared to require more effort to retrieve.

Brian also did well on this bridging task. On level one he used sounding and scanning. He also tried to cover some of the letters with his hands to reduce distractions. Occasionally he would repeatedly attempt a particular sounding, and needed some assistance to attempt alternatives. On level two Brian used sounding and sight vocabulary. He did not seem to be putting forth his best effort on that day, and required some assistance with sounding. On level three Brian had difficulties in finding the words, and did not reach criterion. He became frustrated, and occasionally would not attempt items. He needed some assistance in sounding and finding the words. On the next session Brian's performance improved. He used sounding and blending. He also covered the distracting letters again. Occasionally he used a smaller word within a larger word as a root from which to determine the rest of the word.

Transportation Matrices. Brian achieved flawless performance on all levels of this global task. On level one no specific use of strategies was apparent. On levels one and two Brian would first separate the stimulus cards from the distractors, and then

place them in the proper order. On level three Brian rushed somewhat, but still performed well.

Brian performed well on all levels of the bridging task. On level one no strategy use was apparent. On level two Brian reversed a few letters, but still performed well. On level three Brian spelled out the words and used some rehearsal.

Connecting Letters. Brian's performance was flawless on all levels of the global part of this task. On level one he used the colors instead of the lines to match the letters. On level two he followed the lines with his fingers and scanned with his eyes. He reported that some of the intersections were somewhat confusing. On level three he used scanning, and appeared to be concentrating well.

Brian also performed well on all bridging task levels. On level one he had some difficulties blending sounds and trying alternatives. On levels two and three Brian spelled out the words instead of sounding. He reported that spelling helped him to remember words.

Serial Recall. Brian did well on levels one and two of the global portion of this task, but had difficulty with level three. On level one he used verbalization. On level two he also used rehearsal. On this level he also discovered that there were categories of pictures, and then used this strategy extensively. On level three he also used rehearsal and categorization, but often reversed two of the cards. He did not appear to have been concentrating on this day, and did not reach criterion. On the next session his concentration and his performance improved. He again used categories and rehearsal.

Brian did well on all levels of the bridging task. On level one he sounded out under his breath. He had difficulty with one word, apparently due to a silent letter. On level two Brian spelled words instead of sounding. He had some difficulty in sounding. With some of the words it appeared that, if Brian had an idea of what the word was, this

assisted him in remembering the order of the letters by providing an organizational framework. If he did not have any hypothesis of what the word was, he often confused the order of the letters a great deal. For example, on one item (scarce) he did not know the word, and totally confused the order of the letters in his response. It may have been the case that the letters placed a greater tax on memory when there was no known word to provide a cognitive organization for the letter order. On level three he used spelling, sounding, and predicting.

Window Sequencing. Brian did well on all levels of the global task. On level one no strategies were apparent on series of 2 through 4 shapes. On 5 shape series he began using rehearsal under his breath. He had some difficulty with the longest series (6, 7 shapes), and occasionally reversed two or more shapes. On level two Brian used rehearsal and verbalizing, but had some difficulty with longer series. On level three he also used rehearsal and verbalizing, but often only attended to one feature (shape or color).

Brian also performed well on all levels of the bridging task. On level one he used sounding and blending. The sequencing of the letters appeared to assist Brian in producing the correct sound and reducing impulsivity by focusing attention on each letter in the series. On level two he used spelling, sounding, and rehearsal. On level three Brian used sound blending, verbalizing, and background knowledge to determine the correct word.

After the intervention Brian was asked how he felt that he may have benefited from the training. He said that the training showed him how to have fun with words. He also stated that he learned how to determine unknown words by breaking them down into smaller components. Finally, he stated that the training helped him with organization in reading, spelling, and visual tracking.

Summary

In summary, results from Brian's CAS assessment supported Hypothesis 1, which stated that the intervention would result in improvements in successive processing. Brian's pre-test and post-test performance on CAS tasks indicated improvement in successive processing ability, but no improvement in simultaneous processing, attention, or planning. These results suggested that the intervention specifically improved Brian's successive processing skills. Variation noted in simultaneous processing and attention tasks also indicated that other factors, such as fluctuations in attention and motivation, may have contributed to Brian's performance. This notion was supported by behavioral observations of distraction during intervention, teacher and parent reports of attentional problems, as well as medical diagnosis of hyperactivity.

Brian's performance on reading assessments did not support Hypothesis 2, which stated that the intervention would result in improvements in basic reading skills. Brian's performance on the WRMT-R indicated no significant improvement in basic skills, although error analysis on the Word Attack subtest revealed fewer errors involving vowels and vowel blends. On the comprehension subtests of the WRMT-R no significant changes were noted. Results from the Burns and Roe IRA indicated no improvement in Brian's single word recognition. In oral comprehension Brian's highest instructional rating increased from grade 7 to grade 9, but inconsistencies observed in Brian's performance suggested that this difference did not represent educationally relevant improvement. Results from decoding probes suggested that the training resulted in improvement only on words used in the intervention, and did not generalize to words not used in the intervention.

In contrast to the lack of improvement found in reading measures, significant improvement was noted in Brian's listening comprehension on the Burns and Roe IRA. This task involved sequential organization of ideas, concepts, and relationships, as well

as short-term sequential memory for themes, details, and events. It was inferred that training in successive processing may have improved Brian's ability to organize concepts and events, and therefore resulted in an improvement in listening comprehension. However, these skills did not transfer to reading. There are several possible reasons for this lack of transfer. First, the intensity or duration of the training may not have been sufficient to allow such strategies to generalize to reading processes. Further, miscue analysis on graded passages indicated relatively equal reliance on graphic word analysis and background knowledge to identify words in reading. Therefore, Brian's preferred reading strategies may not have been consistent with the sequential word analysis promoted in training, and did not allow him to make the inferential step of applying these skills to reading.

Mathew

Background Information

At the time of initial assessment Mathew was twelve years and three months of age. He had two younger siblings; one brother (10) and one sister (5). His mother was a student in her second year of a Bachelor of Education program, and his father was a building contractor. Mathew's mother described his early development as normal, stating that he appeared to begin walking and talking at a normal age.

Mathew experienced difficulties throughout his early school years. He repeated grade one, and had received resource room assistance in Language Arts in grades 2 through 4. In resource room the focus of instruction was on decoding and word analysis skills, and included training in initial consonant blends, medial vowels and vowel combinations, and consonant/vowel digraphs. Training was also provided in areas such as visual tracking, understanding grammatical rules, and breaking down words into roots and affixes. In grade 5 Mathew attended a learning center 1/2 time, where Language Arts skills were also the focus of instruction.

At the time of the intervention Mathew was in a regular grade six classroom, and was not receiving extra assistance. Mathew's teacher described him as very verbally articulate. His written expression, however, was limited and slow. Mathew's teacher reported that his reading comprehension was adequate for his grade level. She stated, however, that he had difficulty in basic reading skills, and seldom participated in oral reading in class. Mathew's spelling was also reported to be poor. His teacher stated that he relied heavily on a phonetic approach in spelling, and did not often apply grammatical rules. In arithmetic Mathew's skills were described as above average, with performance in word problems somewhat weaker than computation. However, he did not like performing the steps to solve problems on paper, preferring to solve them in a holistic manner.

Mathew's teacher stated that he was a very proud student, and he did not like to ask for help with his school work. His behavior in class was described by his teacher as somewhat disruptive, but not extremely so. She stated that he often sought diversions from his work. She also stated that he had only a small group of friends at school, and didn't seem to fit in very well with the others.

In December, 1988 a Wechsler Intelligence Scale for Children-Revised (WISC-R) was administered to Mathew. He obtained a Full Scale score of 128, falling within the Superior range. His Verbal scale score of 130 was within the Very Superior range, and his Performance scale score of 120 was within the Superior range. Mathew's WISC-R profile is shown in Table 8. His pattern of performance was consistent with previously discussed patterns typical of HPLD children, with scores in Similarities, Arithmetic, Vocabulary, Picture Arrangement, and Block Design falling within the Very Superior to Superior range, and scores in Digit Span and Coding falling within the Average range.

Mathew also underwent several academic assessments during his school history. In March, 1988 Mathew's reading was assessed with the Woodcock Reading Mastery Test-Revised (WRMT-R). At the time Mathew's Word Identification and Word Comprehension skills were found to be at a grade equivalent (G.E.) of 3.6, approximately 1 to 1.5 years below his grade placement. His Passage Comprehension G.E. was 2.9, approximately 2 years below his grade level. Mathew's weakest performance was found in Word Attack, where his score of 1.9 fell approximately 3 years below his grade level. Mathew's spelling skill was also assessed at this time with the Diagnostic Spelling Potential Profile, and revealed below average performance in spelling, word recognition, and spelling recognition. In June, 1988 a San Diego Quick Achievement Test indicated an instructional level of approximately grade 2. A Schonell Silent Reading Test, administered at approximately the same time, suggested a one year reading delay, and a Schonell Spelling Test indicated a grade equivalent of 3.4. In summary, these

Table 8

Mathew - WISC-R Subtest Profile

Verbal Subtests	Scaled Score	Performance Subtests	Scaled Score
Information	12	Picture Completion	11
Similarities	18	Picture Arrangement	15
Arithmetic	15	Block Design	13
Vocabulary	14	Object Assembly	16
Comprehension	- -	Coding	9
(Digit Span)	11		

Verbal Score - 130

Performance Score - 120

Full Scale Score - 128

assessment results indicated significant delay in language arts skills. Especially weak abilities were noted in basic reading and spelling skills.

Clinical Impressions

Mathew presented as a tall, athletic boy. He was very relaxed and talkative, and was eager to share experiences. In initial reading assessments Mathew did not appear to employ any word analysis strategies. If he did not recognize a word immediately he made an attempt to sound it out, but would quickly pass over it. He seemed very impulsive and hurried in his reading. On the Roswell-Chall Diagnostic Test of Word Analysis Skills Mathew was able to read single consonants and consonant blends, long and short vowels, and vowel blends. He had some difficulty with multisyllabic words. His comprehension was very superior to his basic reading skills, and he appeared to rely on previous information extensively to answer comprehension questions.

Pre-Test/Post-Test Performance

Cognitive Processing

A generally consistent pattern was noted between Mathew's pre-test and post-test performance on the CAS. For the purposes of pre-test post-test comparison, the higher of Mathew's pre-test scores was compared to his post-test score. No significant differences (2 SEM) were found.

Successive processing. Mathew's pre-test and post-test performance in successive processing is displayed in Figure 7. Minor improvements were observed on all successive tasks. In Successive Word Recall, an improvement was found in Mathew's performance of .84 SEM. A very slight increase was noted in Naming Time (.14 SEM). Mathew's Standard Score on Speech Rate increased from 120 to 124, an improvement of

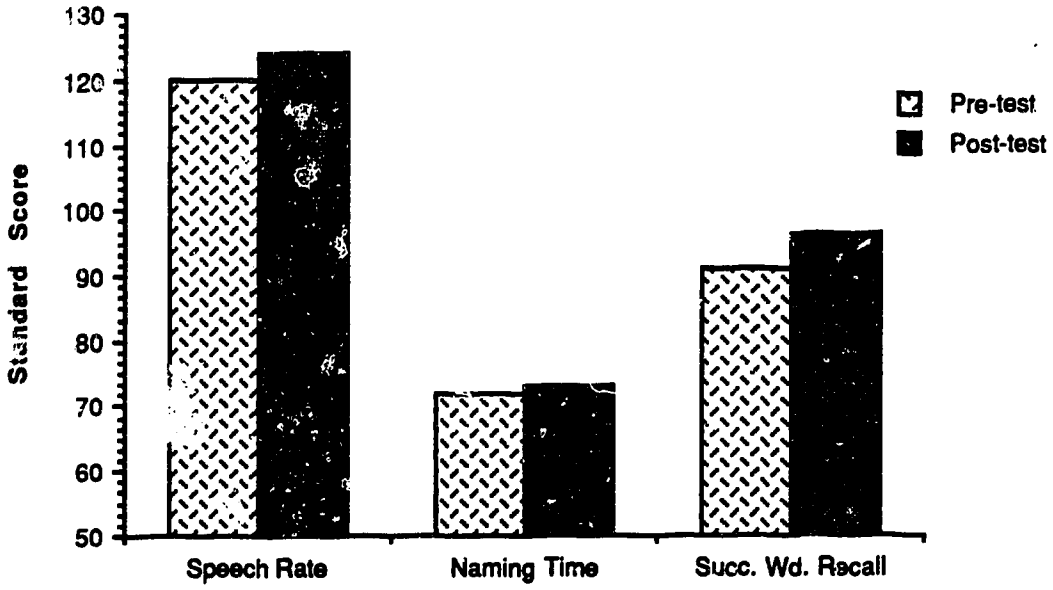

Figure 7. Mathew - Pre-test and post-test standard scores on CAS successive processing tasks.

.90 SEM However, since Mathew's performance was already very high in pre-test, it is possible that a ceiling effect produced an artificially small change in performance. Also, given that this performance required rapid verbal output, it was also possible that further increase in decoding speed was masked by a ceiling in speed of verbal output. In summary, although a trend toward improvement was observed on Mathew's performance on all successive tasks, these improvements did not approach significance. It was inferred, therefore, that the remediation did not improve Mathew's successive processing skills.

Simultaneous processing. Mathew's pre-test and post-test performance in simultaneous processing is displayed in Figure 8. In Figure Memory no change was observed between pre-test and post-test; Mathew's standard score remaining at 120. In Simultaneous Verbal no normative data were available. An improvement was noted, however, in the number of seconds per correct item, which decreased from 6.3 to 4.1. This change (approximately 30%) suggested that some improvement in performance did occur on this task. However, given the lack of normative data, it could not be stated that improvement occurred in simultaneous processing.

Attention. Mathew's pre-test and post-test performance in attention is shown in Figure 9. Two selective attention tasks were administered. The first was Selective Attention Expressive (Stroop task). Because no reliability coefficients were available for this task, SEM could not be calculated. Therefore, the difference between pre and post test Standard scores (Mean=100, SD=15) was examined, and a difference of two SD was considered to be significant. According to this criterion, no significant changes occurred in Mathew's performance. A decrease of .86 SD was found in Word Naming, and a decrease of .60 SD was noted in Color Naming. The second selective attention task administered was Selective Attention Receptive (Posner task). Slight decreases were

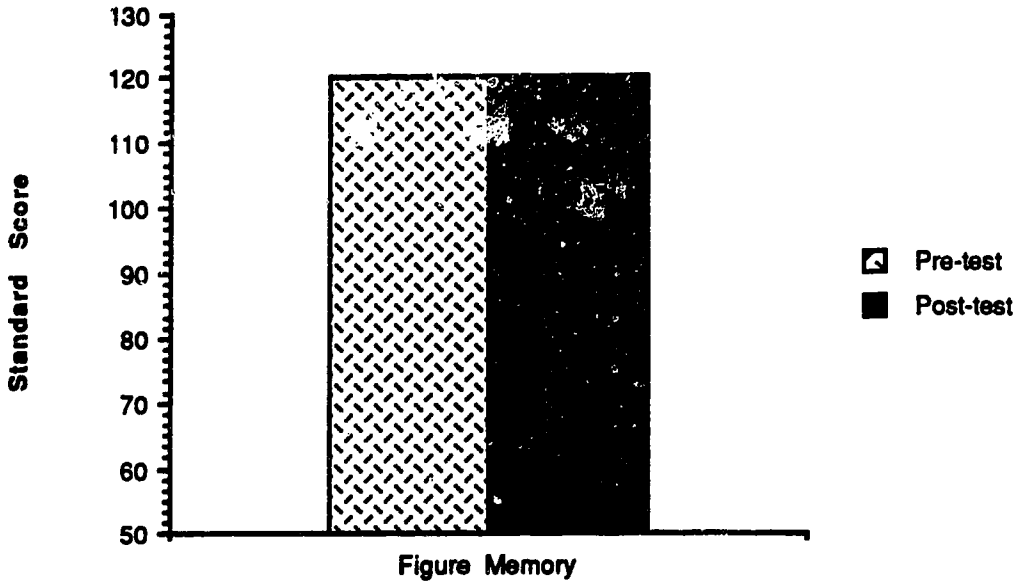

Figure 8. Mathew - Pre-test and post-test standard scores on CAS simultaneous processing tasks.

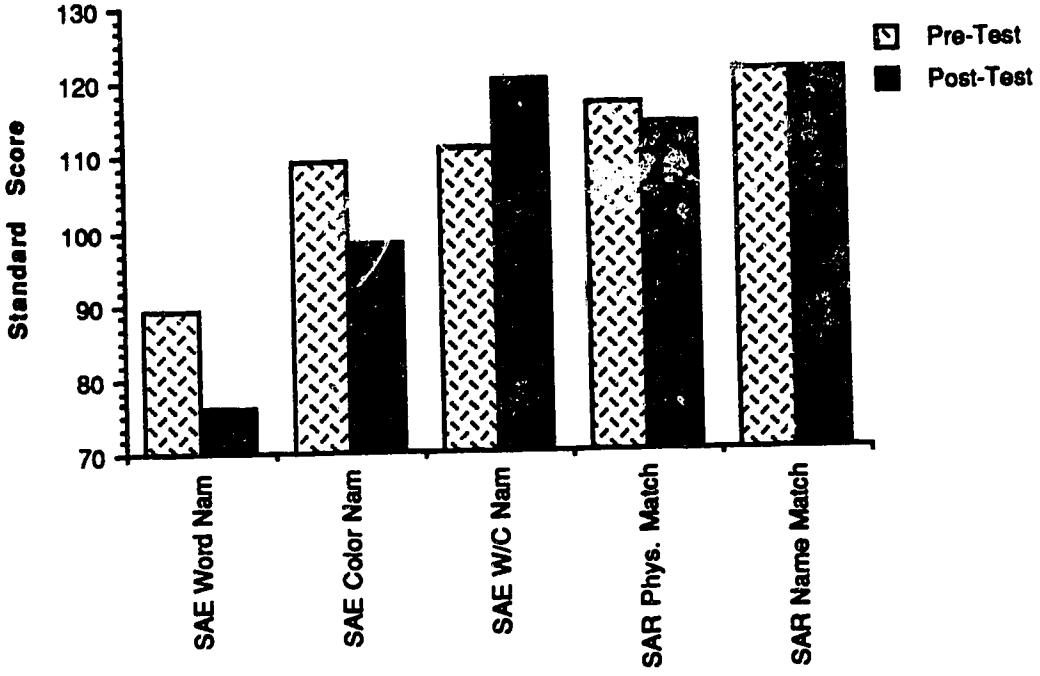

Figure 9. Mathew - Pre-test and post-test standard scores on CAS attention tasks.

found in Physical Match (.50 SEM) and Name Match (.34 SEM). In general, there appeared to be no significant change in selective attention tasks. Therefore, it is inferred that the intervention did not affect attention. Variations in performance on selective attention tasks, however, suggested that attentional fluctuations may have affected Mathew's performance. This notion is supported by behavioral observations indicating distraction, such as engaging in irrelevant conversation and looking about the room, as well as reports of attentional difficulties in school.

Planning. Mathew's pre-test and post-test performance in planning is displayed in Figure 10. An improvement was noted in Planned Connections that approached significance (1.54 SEM). In this subtest strategies such as scanning, rehearsal, and verbalization may be used. Since these strategies were also promoted in many of the intervention tasks, it was possible that some transfer occurred to Planned Connections. No change was found in Mathew's performance on Crack the Code, which remained at a standard score of 93.

In summary, no significant changes occurred on CAS tasks measuring successive processing, simultaneous processing, or attention. In planning, however, improvement was noted in Planned Connections that approached significance, suggesting possible improvement in rehearsal, verbalizing, and visual scanning. Since these strategies were very similar to ones promoted in several of the intervention tasks, it may be inferred that the intervention resulted in improvement in the use of these strategies, but that this improvement was not sufficient to generalize to other successive processing tasks.

One possible reason for the lack of generalization of successive processing strategies was that Mathew may not have been sufficiently challenged by the intervention. He appeared to find a great deal of the intervention very simple, achieving virtually flawless performance on several tasks. If tasks were not sufficiently

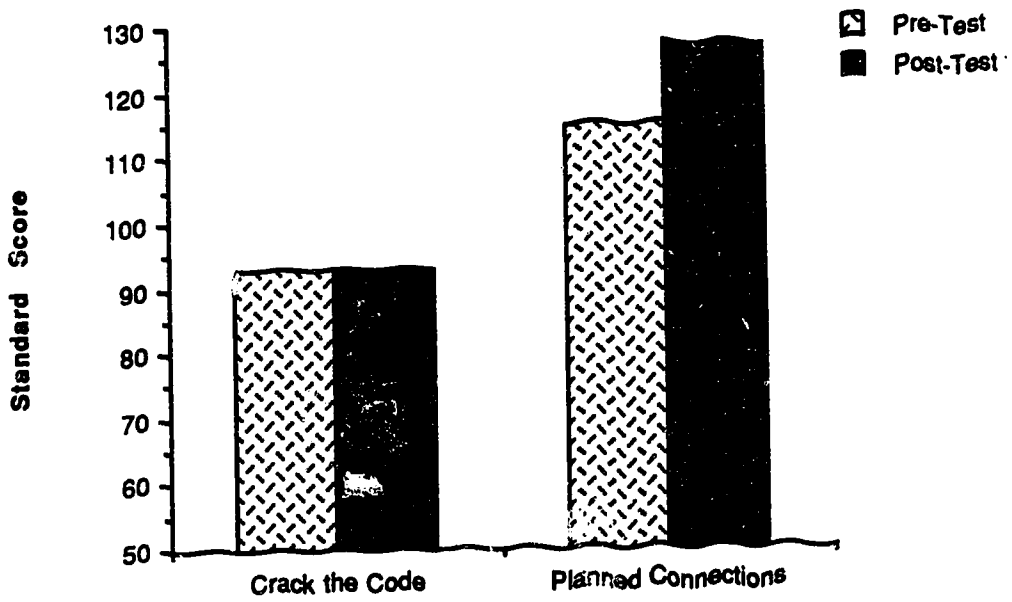

Figure 10. Mathew - Pre-test and post-test standard scores on CAS planning tasks.

challenging to encourage Mathew to employ successive strategies, he may have been able to compensate for successive deficits with simultaneous strategies. If this occurred, then Mathew would not have reflected on or internalized successive strategies, resulting in limited improvement in this area.

Reading

Woodcock Reading Mastery Test Revised. Mathew's pre-test and post-test performance on the WRMT-R is displayed in Figure 11. At pre-test Mathew's performance on the various subtests of the WRMT-R was relatively consistent. The exception to this observation was Mathew's Word Comprehension score, which was substantially superior to the other subtests. At post-test a slight decrease was noted in Mathew's Total Reading score (1 SEM). His Comprehension cluster decreased significantly (3 SEM), and his Basic Skills cluster increased slightly (.67 SEM).

An examination of Mathew's subtest scores indicated no significant changes in basic reading skills. Mathew's Word Identification score decreased by .25 SEM, and his Word Attack score increased by .33 SEM. Error analysis on the Word Attack subtest revealed several errors in single consonants and digraphs at pre-test. This number decreased somewhat at post-test (9 to 6). The number of errors in consonant blends, vowels and vowel blends, and multisyllable words, remained similar.

The substantial decrease noted in Mathew's comprehension score appears to be due to a significant decrease (2 SEM) on the Passage Comprehension subtest. Although this result appears to indicate a decrease in comprehension ability, behavioral observations, as well as Mathew's comments on the day of the post-test, indicated that he was very distracted during the administration of this subtest. On the day of the post-test administration of the WRMT-R Mathew was eager to finish the assessment so that he could participate in an outdoor class activity. Despite encouragement to slow down and

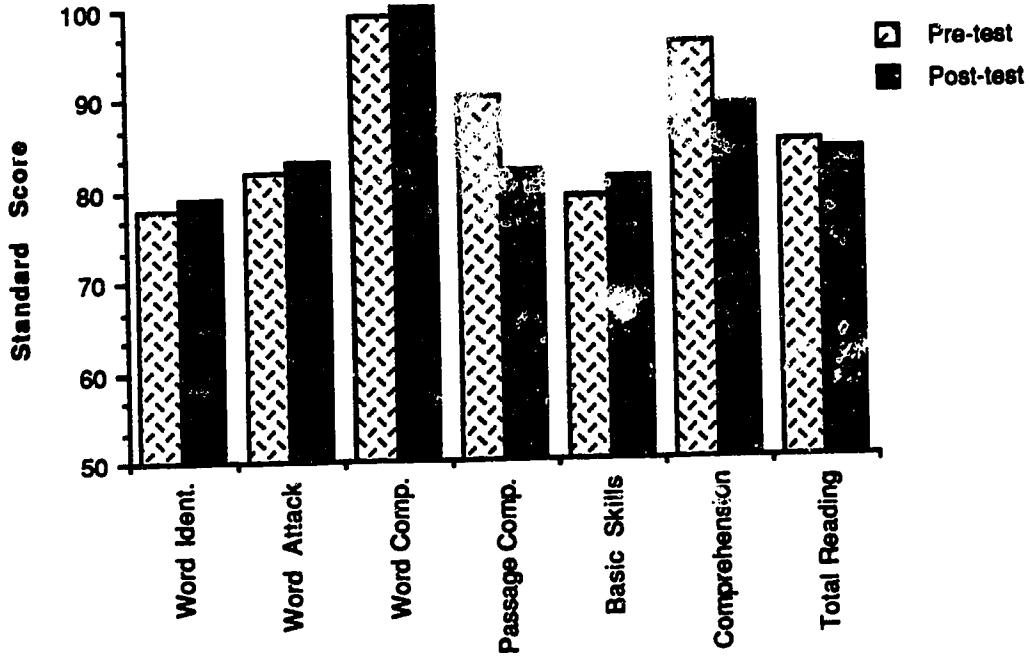

Figure 11. Mathew - Pre-test and post-test standard scores on WRMT-R.

try his very best, Mathew continued to respond very quickly to all items, often not appearing to read the passages at all. Mathew also demonstrated a careless, distracted manner, as inferred from observations such as looking out the window and at the clock. Further, Mathew's comments during the assessment, such as "There goes my class now." and "Are we going to be finished soon?" suggested impatience. Therefore, it was inferred that attentional and motivational factors greatly influenced Mathew's post-test performance. Mathew's pre-test assessment was, therefore, considered to be a more accurate estimate of his abilities. No significant change was noted in Mathew's Word Comprehension score, which improved slightly (.33 SEM). It was inferred from the combination of Mathew's comprehension subtest results that no improvement occurred in this area. Behavioral observations also suggested that attentional factors may have contributed to Mathew's reading performance. This notion is consistent with findings from CAS assessments as well as reports of attentional difficulties in school.

Burns and Roe Informal Reading Assessment. IRA assessment included single word recognition and miscue analysis on Graded Word Lists, as well as assessment of word recognition, oral comprehension, and listening comprehension using Graded Passages.

On Graded Word Lists Mathew obtained similar performance at pre-test and post-test (See Table 9), receiving Independent ratings at grades 2 and 3, and a Frustration rating at grade 4. The number of errors obtained at each grade level remained similar from pre-test to post-test. These results indicated that no improvement occurred in single word recognition. Miscue analysis on Graded Word Lists (See Table 10) indicated approximately equal numbers of mispronunciations and substitutions at pre-test as at post-test. These errors usually involved the middle or end of words, and it appeared as though Mathew attempted to determine the words in a

Table 9

Mathew - Graded Word Lists

Pre-Test

Grade	Score	Level
Level 2	20/20	Independent
Level 3	20/20	Independent
Level 4	14/20	Frustration

Post-Test

Grade	Score	Level
Level 2	19/20	Independent
Level 3	19/20	Independent
Level 4	15/20	Frustration

Table 10

Mathew - Miscue Analysis - Graded Word Lists

Pre-test

Grade	Mis.	Sub.	Ref.	Ins.	Om.	Rep.	Rev.	Total
Level 2	0	0	0	0	0	0		0
Level 3	0	0	0	0	0	0		0
Level 4	3	3	0	0	0	0		6
Total	3	3	0	0	0	0		6

Post-Test

Grade	Mis.	Sub.	Ref.	Ins.	Om.	Rep.	Rev.	Total
Level 2	0	1	0	0	0	0		1
Level 3	0	1	0	0	0	0		1
Level 4	2	3	0	0	0	0		5
Level 5	3	3	0	0	0	0		6
Total	5	6	0	0	0	0		11

holistic manner from their overall configuration, but did not closely examine the actual letter combinations to determine whether he was correct.

On Graded Passages, Mathew's word recognition appeared to be consistent with his grade level, indicating better skill in reading words in context than reading single words. Miscue analysis on Graded Passages at pre-test and post-test (See Table 11) revealed that most errors were substitutions involving the middle and endings of words. Several mispronunciations were also found to involve word middles and endings. Repetitions were also made, and appeared to be an attempt to determine an unknown word by repeating the surrounding phrase. On post-test several omissions were noted, often involving entire lines of text. These errors may have been due to difficulties in visual tracking. However, observations of carelessness in passage reading, such as skipping unnecessary prepositions ("a" and "the"), reading very quickly, and not articulating clearly, suggested that these omissions may have been an attempt to skim the passage and finish quickly. These observations provided further evidence that attentional and motivational factors interfered with reading skill.

A sample of twenty of Mathew's miscues were further examined to determine the number and type of corrections made, the degree of graphic similarity between text words and miscues, and the meaningfulness of miscues. At pre-test Mathew corrected eight of the twenty miscues made. The number of corrections decreased to five at post-test. Most of Mathew's corrections appeared to be based on graphic similarity, as indicated by the large number of common letters between text words and corrected miscues. Further, a large proportion of Mathew's non-corrected miscues were highly graphically similar to the text words at pre-test and post-test. These results indicated that Mathew used graphic word analysis frequently in his reading.

A large proportion of Mathew's errors were of low meaningfulness at pre-test (41%). The number of low meaningful miscues decreased substantially at post-test (20%). This decrease was accompanied by an increase in the number of highly

Table 11

Mathew - Miscue Analysis - Graded Passages

Pre-Test

Grade	Mis.	Sub.	Ref.	Ins.	Om.	Rep.	Rev.	Total
Level 3	1	3	0	0	0	1	0	5
Level 4	2	1	0	0	0	2	0	5
Level 5	3	4	0	0	01	3	0	10
Level 6	2	3	0	1	1	3	0	10
Total	8	11	0	1	2	9	0	30

Post-Test

Grade	Mis.	Sub.	Ref.	Ins.	Om.	Rep.	Rev.	Total
Level 3	0	7	0	0	1	4	0	12
Level 4	1	7	0	1	2	7	0	18
Level 5	0	10	0	0	1	6	0	17
Level 6	0	6	0	0	1	4	0	11
Level 7	3	9	0	2	3	6	0	23
Level 8	6	15	1	1	4	6	0	32
Level 9	4	15	0	2	4	3	0	28
Level 10	7	12	2	0	6	2		29
Total	21	81	3	6	22	38	0	171

meaningful miscues (17% to 33%). Mathew also displayed several partially meaningful miscues at pre-test (41%), and post-test (40%). The number of highly meaningful and partially meaningful miscues indicated that Mathew used background knowledge to assist in word identification in oral reading. Mathew's increase at post-test in highly meaningful miscues, accompanied by a decrease in non-meaningful miscues, suggested an improvement in his ability to monitor and use meaning in his reading.

In summary, the large number of graphically similar miscues, as well as graphically-based corrections, indicated that Mathew used graphics extensively in his reading at pre-test and post-test. The percentage of Mathew's meaningful and non-meaningful miscues suggested that he also used background knowledge to predict words and monitor meaning in reading. The differences in the percentages of high and non-meaningful miscues between pre-test and post-test indicated an improvement in the effectiveness in this strategy. However, this improvement was not sufficient to increase his Instructional rating in word recognition.

In oral comprehension, Mathew's performance was consistent with his grade placement. Pre-test and post-test oral comprehension results are displayed in Table 12. Mathew's highest instructional level increased from grade 6 to grade 9. However, a great deal of inconsistency was observed in Mathew's performance. First, the total percentage of correct responses at equivalent grade levels administered in pre-test and post-test varied greatly. For example, at grade 3 Mathew's total percentage of correct responses decreased 40%, changing his ranking from Independent to Instructional. Inconsistency was also noted within Mathew's post-test performance. For example, he obtained a Frustration rating at grade 6, but then continued to obtain Instructional ratings at grades 7 to 9. An examination of the types of errors made in oral comprehension revealed decreases in the percentage of incorrect responses in Inference (50 to 29%) and Main Idea (40 to 25%). An increase in percentage of incorrect

Table 12

Mathew - Oral Comprehension - Percentage of Errors

Pre-Test

Grade	M.I.	Det.	Seq.	C./E.	Inf.	Voc.	Total	Level
Level 3	0	0	0	0	0	0	0	Indep.
Level 4	0	0	100	100	100	33	40	Inst.
Level 5	0	100	0	0	50	50	40	Inst.
Level 6	100	0	0	0	0	33	20	Inst.
Level 7	100	75	100	50	0	0	50	Frust.
Total	40	27	40	33	50	21		

Post-Test

Grade	M.I.	Det.	Seq.	C./E.	Inf.	Voc.	Total	Level
Level 3	100	20	100	0	50	0	40	Inst.
Level 4	0	0	0	0	50	33	30	Inst.
Level 5	0	0	0	0	50	100	30	Inst.
Level 6	100	40	0	0	50	100	50	Frust.
Level 7	0	0	100	0	50	0	20	Inst.
Level 8	0	67	NA	0	0	75	40	Inst.
Level 9	0	40	NA	50	0	0	20	Inst.
Level 10	0	80	0	100	100	0	60	Frust.
Total	25	33	33	27	29	39		

responses was noted in Vocabulary (21 to 39%). From these results it was inferred that the improvements noted in Instructional grade level did not represent real change in ability, but instead suggested fluctuations in attention and/or motivation between pre-test and post-test. It was concluded that improvement did not occur in oral comprehension .

Mathew's pre-test and post-test performance in listening comprehension is displayed in Table 13. In comparison to Mathew's performance on oral comprehension, he reached much higher grade levels in listening comprehension before obtaining a Frustration rating, indicating that difficulties experienced in oral comprehension may be due to deficits specific to reading. Again, a great deal of inconsistency was noted in Mathew's performance between grade levels. For example, at pre-test Mathew obtained a Frustration rating at grade 9, but obtained an Independent rating at grade 10. At post-test he obtained a Frustration rating at grade 10. Had Mathew's post-test administration been continued, a similar pattern of performance may have been revealed. Mathew also obtained a Frustration rating upon post-test at grade 4. These results indicate that attentional and motivational factors may have contributed to Mathew's performance. It was inferred, therefore, that no change occurred in Mathew's listening comprehension.

Perception of Abilities

Mathew's results on the PASS is displayed in Table 14. An overall increase was noted in Mathew's perception of his academic abilities. However, Mathew's Full Scale score remained within the average range. Mathew demonstrated significant improvement in several areas. His score in Reading/Spelling increased from "below average" to "average". An improvement was also noted in Confidence, changing from "average" to "above average". In Arithmetic, Mathew's score also improved from "average" to "strong". It was inferred from these results that Mathew was more confident in his ability to cope with school work. This increased confidence may have

Table 13

Mathew - Listening Comprehension - Percentage of Errors

Pre-Test

Grade	M.I.	Det.	Seq.	C./E.	Inf.	Voc.	Total	Level
Level 5	0	0	50	0	33	0	20	Inst.
Level 6	0	33	0	0	50	66	40	Inst.
Level 7	0	40	NA	100	0	50	30	Inst.
Level 8	100	50	0	0	0	50	40	Inst.
Level 9	100	66	100	0	0	33	50	Frust.
Level 10	0	0	0	0	0	0	0	Indep.
Level 11	0	50	0	100	100	100	70	Frust.
Total	29	36	29	29	33	42		

Post-Test

Grade	M.I.	Det.	Seq.	C./E.	Inf.	Voc.	Total	Level
Level 4	100	60	0	0	0	50	50	Frust.
Level 5	0	0	0	0	25	50	20	Inst.
Level 6	0	0	0	0	25	0	10	Indep.
Level 7	100	33	0	100	67	0	40	Inst.
Level 8	100	0	NA	0	0	25	20	Inst.
Level 9	0	33	100	0	33	50	40	Inst.
Level 10	100	80	NA	0	0	100	70	Frust.
Total	57	39	20	13	28	41		

Table 14

Mathew - Performance on Perception of Abilities Scale for Students

Subscale	Pre-Test	Post-Test
General Ability	5 below avg.	6 below avg.
Arithmetic	10 average	12 strong
Reading/ Spelling	7 below avg.	10 average
Penmanship/ Neatness	9 average	9 average
School Satisfaction	5 below avg.	2 weak
Confidence	5 average	7 above avg
Full Scale	41 weak	46 weak

been the result of the perception of a greater number of strategies to employ in school, especially in reading.

A decrease was noted in Mathew's rating in School Satisfaction, which fell from "below average" to "weak". This score reflects perception of curricular as well as extracurricular activities, such as rapport with peers and teachers. Mathew had commented towards the end of the intervention that he had been having some conflict with his teacher over his homework. Mathew's teacher had also reported that she had had to reprimand him for not bringing in his homework on several occasions. This conflict may have caused a decline in rapport between Mathew and his teacher, thus lowering his School Satisfaction.

In general, these results indicated that the intervention resulted in an increase in Mathew's confidence in his academic abilities, possibly due to a perception that he possessed more strategies with which to cope with school work, and especially with reading.

Dynamic Assessment

Decoding Probes

All words used in probes, as in the intervention, were known. Therefore, any changes in performance should not be due to practice effect, but instead reflected actual change in decoding ability. Probes 1, 3, and 5 were composed of words which were used in the intervention at each difficulty level. The difference between first and second administration of these probes indicated improvement due to direct training within the context of the intervention. Probes 2, 4, and 6 were composed of words of the same complexity as probes 1, 3, and 5 respectively, but which were not used in the intervention. Mathew's scores on these probes were compared to his post-test scores on 1, 3, and, 5 to determine whether generalization of training occurred.

Mathew's performance on decoding probes is shown in Figure 6. Improvement was noted between pre-test and post-test performance on probes 1, 3, and 5. It was also observed that the magnitude of this improvement increased with increasing complexity of words. Since it is likely that Mathew was most competent with the less complex words, it is possible that his decoding performance on the probes containing these words reached a ceiling. With more complex words, however, Mathew may not have been as competent. Therefore, greater improvement may have been possible before reaching such a ceiling, resulting in a greater magnitude of improvement on these probes. The observation of similar post-test performance on probes 1, 3, and 5 supports this notion. In general, however, the improvements noted between the pre-test and post-test of these probes indicated that training did have a direct effect on words that were used in the remediation.

As mentioned earlier, the purpose of probes 2, 4, and 6 was to determine whether generalization of training occurred If generalization occurred, it would be expected that the scores for probes 2, 4, and 6 would be similar to the post-test on probes 1, 3, and 5. However, the observation that Mathew obtained substantially higher scores in seconds/word correct on probes 2, 4, and 6 than on the post-test of probes 1, 3, and 5 suggested that training did not generalize to words that were not used in the intervention. It was concluded, therefore, that the intervention resulted in an improvement for words that were used in the training, but that this improvement did not generalize to words that were not used.

Intervention - Qualitative Impressions

Mathew generally performed very well throughout the intervention, which involved approximately 14 hours of one-on-one intervention within 5 weeks. Strategies employed in global tasks included verbalization, rehearsal, scanning, using categories, associations, and rhyming to assist in memory for sequences, using colors,

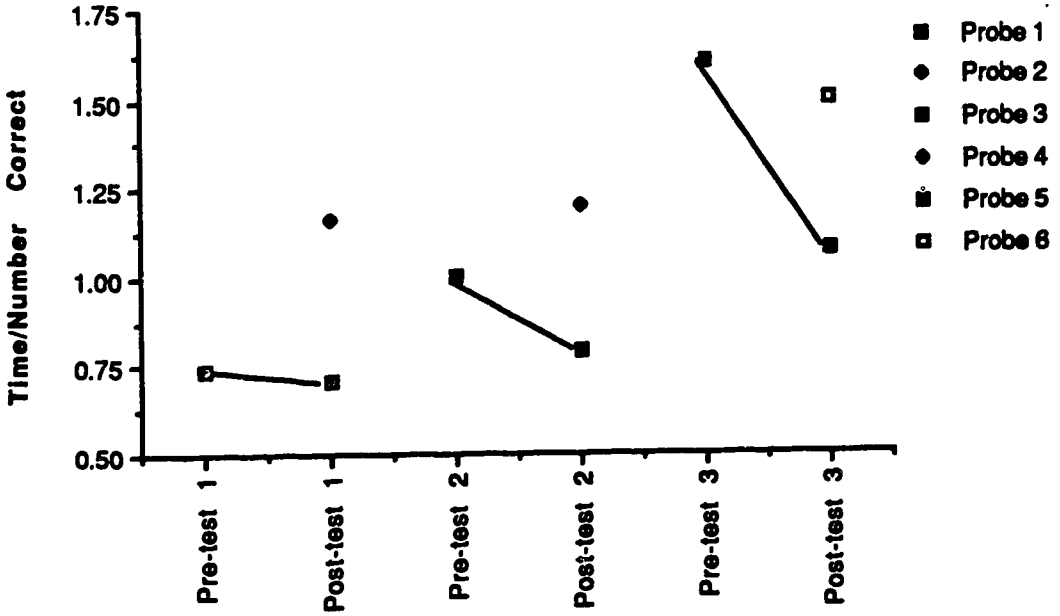

Figure 12. Mathew - Decoding probe performance.

patterns, and shapes to match fronts and backs of pictures, and eliminating alternatives. During bridging tasks dominant strategies were sounding, using background knowledge, sound blending, rehearsal, predicting and revising, and visual scanning. Mathew had difficulties on some of the bridging tasks when he did not have the opportunity to see the entire word, and therefore was required to hold letters in short-term memory and synthesize them to produce the word without the aid of a model.

Related Memory Set. On all levels of the global portion of this task Mathew performed very well, using patterns, colors, shapes, and background information to match animals. His performance was virtually error free.

Mathew also performed well on the bridging portion of this task. On level one Mathew did well, but admitted rushing somewhat in his responses. On level two he used sounding and attempting alternatives. He had some difficulties, however, with vowel combinations and visualizing the words as a whole. On level three he used sounding and elimination to determine the words, but had some difficulties sounding.

Joining Shapes. Mathew performed well on all levels of this global task. On level one he had no difficulties in following instructions. On level two he attempted to respond before the instructor was finished giving the instructions, but was reminded to wait until all of the instructions were given. He then started to repeat the instructions after the instructor. On the third level Mathew traced the connections in the air with his pencil while the instructor was saying them, apparently providing himself with a visual reinforcement of the pattern. He also repeated the instructions.

Mathew had some difficulty with the bridging component of this task. On level one Mathew performed well, but had some difficulty remembering the rules to finding the words. He seemed to be looking for the instructor's approval before actually making the connections, apparently not trusting his own abilities. Towards the end of the

session, however, he appeared more comfortable with the task. On level two Mathew was much more competent in the task, and used sounding, sight vocabulary, scanning, and prediction. On level three Mathew had some difficulty in finding the words, and did not meet criterion. When he recognized the words he seemed to find them very quickly, but when he did not recognize them and was required to sound them out, he often appeared unable to perform, and quickly lost motivation. The third session was administered a second time. Since only a limited number of stimuli were available at this level, the same stimuli had to be used again. A distinct practice effect was inferred from Mathew's statements, such as "These ones again?" and "I remember this.". He was easily able to find the words again.

Transportation Matrices. Mathew performed very well on all levels of the global component of this task. On levels one and two he used verbalizing and cues in the pictures to remember the sequences. On level three he also used rehearsal.

Mathew also performed well on the bridging part of this task. On level one no strategy use was apparent. On level two he reversed a few letters in words, but this appeared to be due to rushing his responses. On level three he used sounding.

Connecting Letters. Mathew's performance on the global portion of this task was virtually error free. On level one he used the colors instead of following the lines to determine which letters were connected. On level 2 he found some of the intersecting lines difficult, and used his fingers occasionally to follow the lines. On level three he used visual scanning extensively, and also used elimination.

Mathew performed well on all levels of this bridging task. On level one he used sounding and scanning. He rushed somewhat, thus making some mistakes, which he easily corrected upon second trial. On level two he tried to use his fingers, but was encouraged not to do so. He also used sounding under his breath. On level three he

demonstrated some confusion at intersecting lines, and attempted to rely on the proximity of the letters instead of the colors of the lines to determine the words. He rushed at the beginning of the task, but slowed down toward the end and performed well.

Serial Recall. Mathew performed generally well on this global task. On level one he used verbalizing, and found the task very easy. On level two he used rehearsal and verbalizing. On level three Mathew had some difficulty, and often reversed two or more pictures of the sequence. He was told to look for categories among the pictures, a strategy which he used extensively thereafter. He also used associations and rhyming to remember sequences. He did not reach criterion, however, on this level. On the second session of level three he used association and categories, performing well.

Mathew found the bridging component of this task very easy, and performed well on all levels. On level one he used sounding and the colors of the plastic letters to remember the sequences. He had difficulty with one word due to a silent letter. On level two he used sounding and a great deal of predicting based on the first letters of the words. He had some difficulty sounding a few words. On level three he used predicting and revising almost exclusively, and enjoyed revising his prediction with each new letter presented.

Window Sequencing. Mathew performed well on the global portion on all levels presented. On level one he used verbalization to remember the shapes, and had no difficulty with the sequences. On level two Mathew used rehearsal. The longer sequences towards the end of the session seemed to require additional concentration from Mathew, but he still performed well. On level three he used rehearsal and rhyming. He also tried to use the pattern of shapes or colors to remember the sequence, but usually focused on only one dimension at a time. He had some difficulty, therefore, on some of the longer sequences.

Mathew performed well on all levels of the bridging task. On level one he used sounding and verbalizing. On level two Mathew frequently used predicting. He made some mistakes on this level, apparently due to impulsiveness. He had difficulty sounding the word "sleigh" because of silent letters. On level three Mathew used sounding.

After the intervention Mathew was asked how he thought the training may have benefited him. He said that he learned "how to have fun with words". He also said that the training was useful in helping him break down and sound out words that he did not know. Finally, he stated that the training improved his memory for sequences of items. He told the instructor of some lessons in science where he had to remember the order of events or instructions, saying that he used some of the strategies promoted in the intervention helped him to remember the sequences.

Summary

In summary, results from CAS pre-test and post-test assessments provided minimal support for hypothesis 1. Mathew's performance on CAS tasks indicated consistent, but insignificant, improvement on all successive tasks. However, improvement was found that approached significance on one planning task, Planned Connections. Performance on this task may have benefited from many of the same strategies as were encouraged on several of the tasks within the intervention, such as scanning, predicting, rehearsal, and verbalization. It is possible, therefore, that training resulted in improvement in some of these strategies, but did not generalize to other successive processing tasks.

In general, evidence from pre-test and post-test reading assessments did not support hypothesis 2. Mathew's scores on the WRMT-R did not improve significantly from pre-test to post-test. In fact, a significant decrease was noted in Passage Comprehension, although behavioral observations suggested that this decrease was due to

specific attentional factors on the day of assessment. Results from the Burns and Roe IRA suggested no improvement in single word recognition, word recognition in context, oral comprehension, or listening comprehension. It was noted that, unlike Mathew's single word reading, his performance on word recognition in context and comprehension appeared to be consistent with his grade placement, indicating difficulties specific to decoding. Mathew's performance on decoding probes suggested that improvement occurred in decoding words which were used in the intervention, but that this improvement did not generalize to words which were not used in the intervention.

Several factors may have contributed to Mathew's lack of improvement in reading skills over the course of the intervention. The first factor involved the ease with which Mathew performed the tasks in the intervention. These tasks may not have been sufficiently challenging to encourage Mathew to employ successive processing strategies, instead allowing him to compensate with simultaneous strategies. If this was the case, then Mathew would not have internalized the successive strategies, or generalized these strategies to areas such as reading. A second possible reason for the lack of reading improvement is that attentional and motivational factors interfered with Mathew's performance. This could have affected his performance in two ways. First, fluctuations in attention and/or motivation may have inhibited Mathew from obtaining the maximum benefit from the intervention. Second, attentional difficulties during pre and post testing may have masked any improvement that occurred as a result of the intervention. Finally, Mathew's preferred reading strategies may not have been consistent with the strategies encouraged in the intervention. As inferred from Mathew's miscues, his reading strategies appeared to involve both examining words graphically and monitoring for meaning. Therefore, he may not have made the inferential step to applying the sequential word analysis promoted in the intervention to his reading. An improvement was noted, however, in his ability to use background knowledge and monitor for meaning in reading. This improvement may have been due to a reduction of impulsivity in

reading and employing a more systematic, sequential analysis of the text. However, this improvement did not result in an improvement in Instructional level of word recognition.

Mathew's performance on the PASS indicated an improvement in perception of academic abilities, especially in reading/spelling, arithmetic, and confidence. A decrease noted in School Satisfaction was inferred to be related to a decline in rapport with the teacher toward the end of the year. These results indicated that Mathew's self-confidence with respect to his academic abilities improved over the course of the intervention, possibly due to a perception of more strategies with which to cope with school work.

Mathew's increase in perception of academic abilities stands in contrast to his lack of improvement on CAS and reading assessments. Mathew's comments during intervention provide a possible explanation for this apparent contradiction. At one point in the intervention Mathew said that he felt that the training was "useful". When asked to explain what he meant, he said that it was helpful in remembering series of details and sequences of information presented in lessons. He recalled a specific science lesson in which he was required to remember a sequence of events, stating that the training tasks assisted him in remembering the information. Therefore, Mathew's increased perception of abilities may have been due to an employment of successive strategies to academic areas other than reading.

In conclusion, slight improvement noted on all successive processing tasks, and improvement that approached significance in Planned Connections indicated that some improvement in successive strategy use did occur. However, Mathew's reading scores indicate that these strategies did not generalize to reading. Improvement on the PASS, as well as Mathew's comments concerning the benefits of the intervention, indicate that successive strategies may have generalized to other academic areas. Inconsistencies in performance on many cognitive and reading tasks, as well as behavioral observations of

distraction during the intervention, indicated that attentional and motivational factors may also have influenced Mathew's performance.

Colin

Background Information

At the time of initial assessment, Colin was 10 years and 10 months old. His mother reported that he was born 7 weeks premature as one of a set of fraternal twins, and stayed in hospital an additional 6 weeks after birth. Colin's mother reported that his early development was normal.

Colin's reading difficulties were noted in grade one. He received extra assistance in resource room in grades 2, 3, and 4 in Language Arts. Colin was in a regular grade 5 class at the time of intervention and was not receiving extra assistance. His home room teacher stated that his performance was generally low in all subjects. She stated that his highest performance was in Science and Arithmetic, where his functioning was average. She noted that he enjoyed discussions in Science. In Language Arts Colin's teacher reported that his greatest areas of difficulty were reading comprehension and written expression. She stated that, although his oral communication skills were good, he had difficulty putting ideas down on paper, with most problems involving organization of written material, punctuation, and sentence structure. Colin's teacher reported that he was very active in class, and had difficulty maintaining attention. He was also somewhat disruptive, and often talked to others excessively or made strange noises during class.

A WISC-R was administered to Colin in March, 1987. His Full Scale score of 124 placed his overall intellectual functioning within the Superior range. His Verbal Scale score (118) was within the High Average range, and his Performance Scale score (128) was within the Superior range. His subtest profile is displayed in Table 15. The pattern of subtest scores displayed by Colin was very similar to that described in the research as common among HPLD children. Colin's highest scores were in Similarities, Vocabulary, Coding, and Object Assembly. His lowest scores were in Digit Span, Arithmetic, and Block Design.

Table 15

Colin - WISC-R Subtest Profile

Verbal Subtests	Scaled Score	Performance Subtests	Scaled Score
Information	11	Picture Completion	13
Similarities	15	Picture Arrangement	15
Arithmetic	10	Block Design	9
Vocabulary	15	Object Assembly	- -
Comprehension	- -	Coding	18
(Digit Span)	8		

Verbal Score - 118

Performance Score - 128

Full Scale Score - 124

Colin's achievement scores on the Canadian Test of Basic Skills, administered in grades 1, 2, 3, and 4, revealed that each year Colin demonstrated a consistent pattern of performance, with Vocabulary and Reading subtests being inferior to Computation and Problem Solving subtests by approximately 25 percentile points. This suggested that Colin's greatest area of difficulty had consistently been in Language Arts. However, his standing, relative to his age group, declined each year. This indicated an overall delay in academic performance, possibly due to motivational factors associated with early reading difficulties.

Clinical Impressions

Colin presented as a healthy, fair haired child of approximately 4'10" to 5'. He was polite and cooperative during initial assessments, and over the course of the intervention became more outgoing and talkative. Colin's attention to task was usually adequate. At times, however, when he was not in a good mood or did not want to participate in the intervention , his motivation and attention to task appeared to decrease a great deal.

During initial assessments Colin appeared to monitor the instructor closely for clues as to whether he was responding correctly. His performance on the Roswell-Chall Diagnostic Test of Word Analysis Skills indicated adequate sound-symbol correspondence for single letters, consonant blends, short and long vowels, and vowel blends. Colin had a great deal of difficulty, however, in reading multi-syllabic words.

Colin's pre-training reading strategies appeared to be holistic, as he seemed to determine words from their overall configuration. His preferred strategy for pronouncing a word that he did not recognize by sight was to repeat it several times, slightly changing the sound each time, until the sound approximated a word that he knew. However, he did not appear to closely examine the actual letter combinations which made up the word, for he would often pronounce sounds which were not present. When errors

were pointed out, and Colin's looked more closely at the word, he could often read it easily.

Pre-Test/Post-Test Performance

Cognitive Processing

Some variability was noted in Colin's performance on CAS tasks; his scores fluctuating considerably from administration to administration. This variability may have indicated that factors such as motivation and attention contributed to his CAS performance. For the purposes of pre-test, post-test comparison, the higher of his pre-test scores was considered to be the most accurate estimate of Colin's abilities.

Successive processing. Colin's performance on successive processing tasks is displayed in Figure 13. A significant improvement was noted in Speech Rate of 2.17 SEM., suggesting an increase in facility and speed of sequential word analysis. On Successive Word Recall, Colin's performance improved slightly (.84 SEM). A slight decrease was noted in Colin's performance on Naming Time (.45 SEM), which also measures sequential decoding ability. The significant improvement on one successive processing task, and trend towards improvement on another task, suggested that Colin improved in some aspects of successive processing ability, particularly those related to word analysis.

Simultaneous processing. Colin's performance on simultaneous processing tasks is presented in Figure 14. In Figure Memory Colin's performance decreased slightly (.76 SEM). In Simultaneous Verbal no normative data were available. However, a slight decrease was noted of 10.4 seconds per correct response to 10.6 seconds per correct response. Since the changes on simultaneous processing tasks did not appear to be

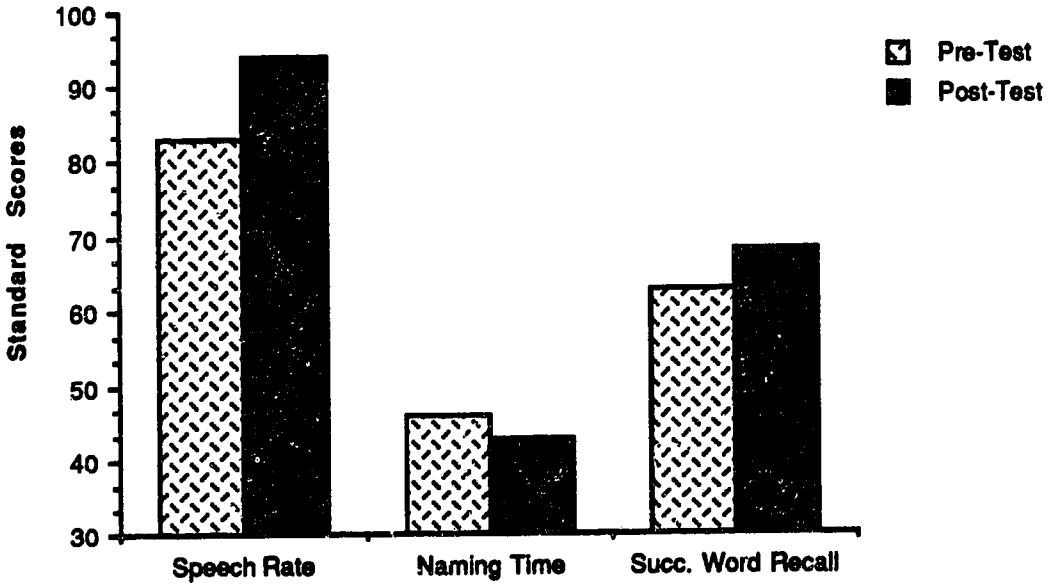

Figure 13. Colin - Pre-test and post-test standard scores on CAS successive processing tasks.

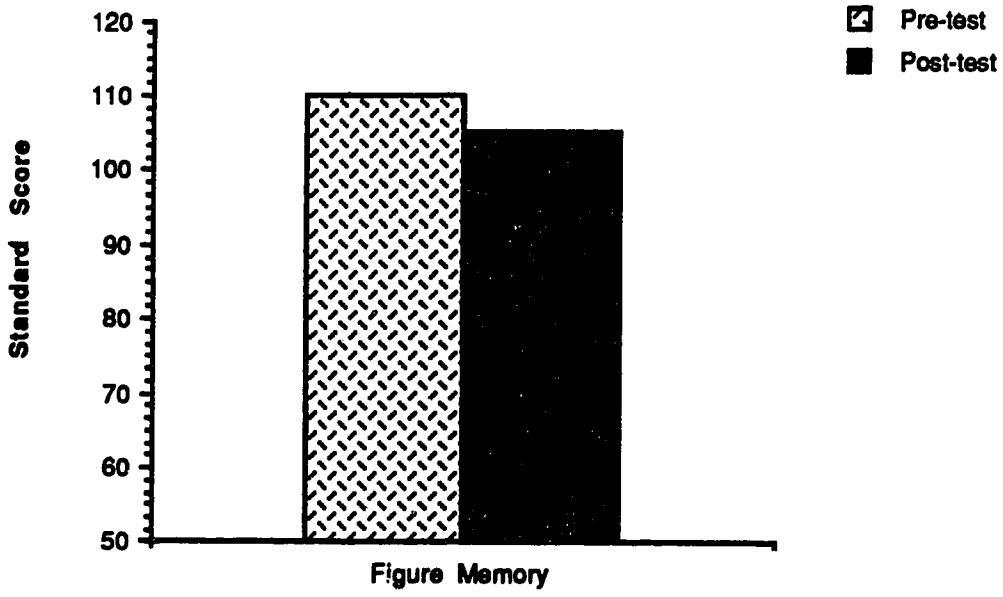

Figure 14. Colin - Pre-test and post-test standard scores on CAS simultaneous processing tasks.

significant according to the aforementioned criterion, it was inferred that no improvement occurred in Colin's simultaneous processing.

Attention. Colin's performance on attention tasks is presented in Figure 15. The first selective attention task administered was Selective Attention Expressive (Stroop task). Since no reliability coefficients were available for this task, SEM could not be calculated. Therefore, the difference between pre and post test standard scores (Mean=100, SD=15) was examined, and differences of two SD were used as the criterion for determining significant change. No significant differences were observed between pre-test and post performance in Word Naming or in Color Naming. In Word/Color Naming, however, a decrease in performance that approached significance (1.67 SD) was noted. Since this task has a very high selective attention component, requiring students to attend to the color of the ink of the words while simultaneously ignoring the color stated by the words, this decrease may have indicated fluctuations in Colin's attentional ability. Teacher and parent reports of attentional problems, as well as inconsistent performance on several CAS tasks, support this hypothesis.

The second selective attention task administered was Selective Attention Receptive (Posner task). A significant decrease was observed in Physical Match of 4.83 SEM. It was also noted, however, that Colin's performance on this subtest varied a great deal from first to third administration, his Standard Score falling from 104 at first pre-test to 63 at second pre-test, and increasing again to 77 at post-test. This pattern of scores also supported the notion of attentional difficulties affecting Colin's performance.

It was inferred from these results that no improvement occurred in selective attention as measured by the CAS. Further, the inconsistent pattern of performance observed on two of the attention subtests suggested that Colin may have had difficulties maintaining attention to task. This notion was supported by observations of difficulties

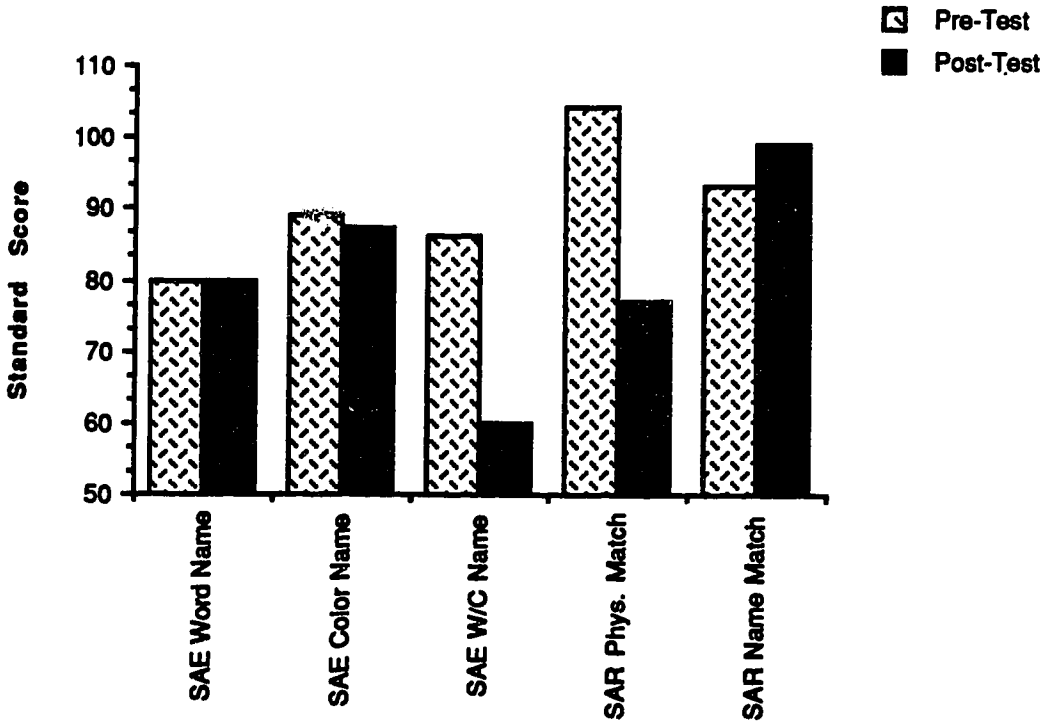

Figure 15. Colin - Pre-test and post-test standard scores on CAS attention tasks.

in attending to task during the intervention, including looking about the room and getting out of seat, and reports of attentional difficulties in class.

Planning. Colin's performance on planning tasks is presented in Figure 16. On Crack the Code no change in score was noted, Colin's standard score remaining.at 85. A slight decrease was observed in Planned Connections (.61 SEM). From these results it was inferred that no improvement occurred in planning ability.

In summary, the only significant improvement in Colin's CAS performance was found in Speech Rate, a successive processing task measuring facility and speed of sequential word analysis and verbalization. A slight improvement was found in Successive Word Recall. These were the largest increases found in Colin's CAS performance, and stand in contrast to the lack of improvement noted in simultaneous processing or planning. It was inferred from these results that the intervention specifically improved Colin's performance in successive processing.

An inconsistent pattern of performance was also observed on several attention tasks. This fluctuation in performance suggested that Colin's ability to attend to task was not consistent. This hypothesis was supported by behavioral observations of distraction as well as reports of attentional difficulties in school, and suggested that attentional factors may contribute to Colin's cognitive and academic performance.

Reading

Woodcock Reading Mastery Test-Revised. Colin's performance on the WRMT-R is displayed in Figure 17. Colin's overall cluster scores in Basic Reading Skills, Comprehension, and Total Reading Ability remained virtually unchanged from pre-test to post-test. This pattern of performance indicated that the intervention did not have a significant overall affect on Colin's reading abilities. A comparison of Colin's WRMT-R

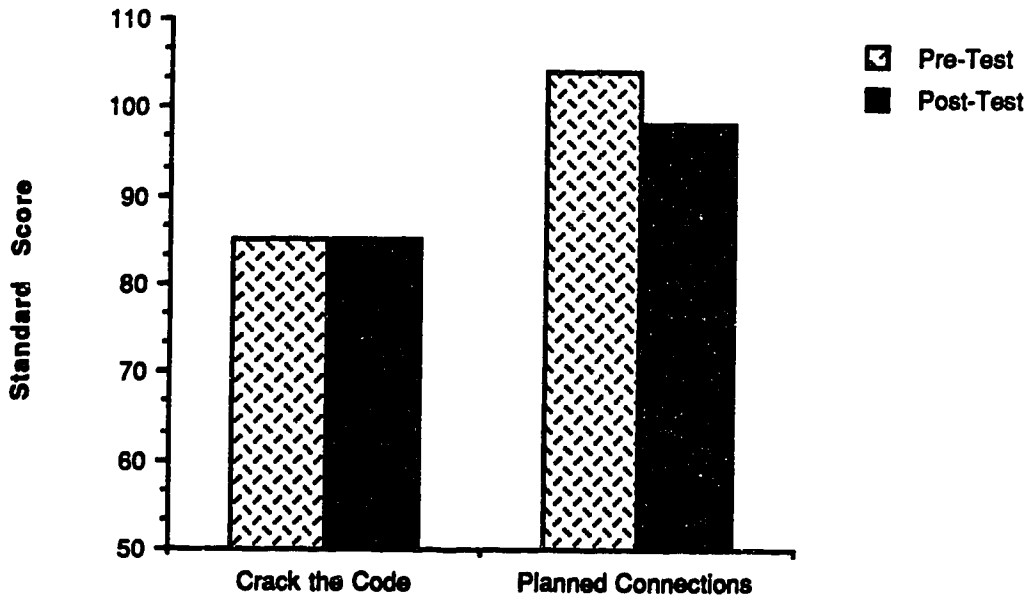

Figure 16. Colin - Pre-test and post-test standard scores on CAS planning tasks.

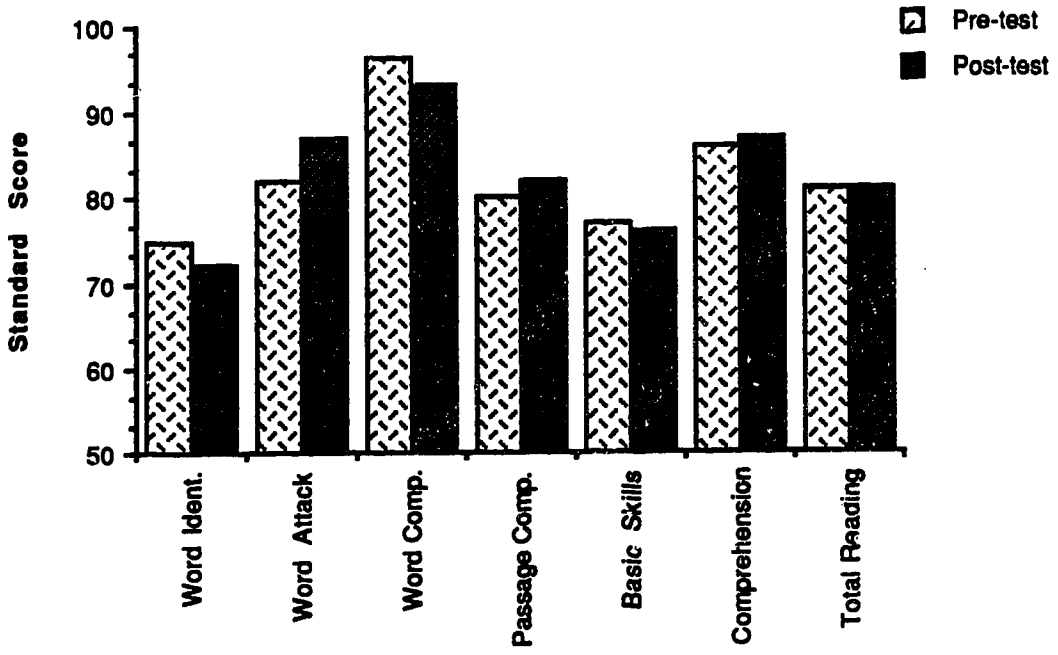

Figure 17. Colin - Pre-test and post-test standard scores on WRMT-R.

subtest profiles indicated consistency in his reading ability, with performance in all subtests being relatively equivalent. The exception to this consistency was noted in Word Comprehension, which was substantially superior to his other subtest scores.

A comparison of Colin's pre-test and post-test performance in basic reading skills revealed an increase of 1.25 SEM in Word Attack. This difference, while not meeting the 2 SEM criterion, suggested a trend towards improvement in word analysis skills. A slight decrease was noted in Word Identification (.5 SEM). It was inferred, therefore, that slight improvement occurred in decoding skill, but that this improvement was not sufficient to transfer to word identification.

In comprehension, Colin displayed a decrease in Word Comprehension which approached significance (1.33 SEM), suggesting a trend towards decrease in this area. This decrease may have been due to differences in the nature of the material in the task and the extent to which Colin was able to use his background knowledge to respond to the items. Behavioral observations, such as looking about the room and engaging in unrelated conversation during the assessment, also suggest that attentional difficulties may have contributed to Colin's performance on this task A slight improvement was noted in Colin's Passage Comprehension (.5 SEM).

Burns and Roe Informal Reading Assessment. IRA assessment included single word recognition and miscue analysis on Graded Word Lists, as well as assessment of word recognition, miscue analysis, oral comprehension, and listening comprehension using Graded Passages.

Colin's pre-test and post-test performance on Graded Word Lists is displayed in Table 16. No change was noted in Colin's instructional grade level. It was observed, however, that more words were read correctly on post-test at all grade levels except grade 2. At grades 1 and 3 this increase improved Colin's rating from Instructional to Independent, and improved his performance at grade 4 from 8/20 to 12/20 words

Table 16

Colin - Performance on Graded Word Lists

Pre-Test

Grade	Score	Level
Pre-Primer	20/20	Independent
Primer	18/20	Independent
Level 1	17/20	Instructional
Level 2	19/20	Independent
Level 3	17/20	Instructional
Level 4	8/20	Frustration

Post-Test

Grade	Score	Level
Primer	20/20	Independent
Level 1	18/20	Independent
Level 2	18/20	Independent
Level 3	20/20	Independent
Level 4	12/20	Frustration

correct. These results suggested that intervention may have contributed to an improvement in single word reading skills, but that this improvement was not sufficient to result in an increase in instructional grade level on this task.

Miscue analysis on Graded Word Lists is presented in Table 17. Results on both pre-test and post-test indicate that most miscues made by Colin on levels Primer to 3 were substitutions, usually involving mispronunciation of the middle or end of words. At grade 4, however, mispronunciations were more prominent, also involving the middle of the words. Although the type of miscues made by Colin were similar in pre-test and post-test, a substantial decrease in the number of miscues was observed. Decreases were observed in substitutions (12 to 6) and in mispronunciations (9 to 6) at grade levels Primer to 4. These results may indicate that Colin was attending more closely to the actual letter combinations within the words instead of trying to decipher words by their overall configuration.

Colin's number and type of miscues on Graded Passages is displayed in Table 18. Most miscues on both pre-test and post-test were substitutions involving word middles and endings of words. Suffixes were often added or omitted. For example, the contraction "n't" was added to several words such as "couldn't and didn't". Several mispronunciations were also noted, again involving word middles and endings. Repetitions and omissions were also noted. It was observed that Colin obtained more miscues at grade levels 3 and 4 at post-test than pre-test, especially in substitution and repetition. This increase may have been due to the specific nature of the passages and Colin's ability to employ background knowledge.

A portion of Colin's miscues were further examined to determine the number and type of corrections made, the degree of graphic similarity between text words and miscues, and the meaningfulness of miscues. Colin corrected approximately 25% of miscues at pre-test, and 30% at post-test. His corrections were based equally on graphics and meaning. At pre-test Colin obtained a very high proportion of highly

Table 17

Colin - Miscue Analysis - Graded Word Lists

Pre-Test

Grade	Mis.	Sub.	Ref.	Ins.	Om.	Rep.	Rev.	Total
Primer	0	2	0	0	0	0	0	2
Level 1	0	3	0	0	0	0	0	3
Level 2	0	1	0	0	0	0	0	1
Level 3	1	2	0	0	0	0	0	3
Level 4	8	4	0	0	0	0	0	12
Total	9	12	0	0	0	0	0	21

Post-Test

Grade	Mis.	Sub.	Ref.	Ins.	Om.	Rep.	Rev.	Total
Primer	0	0	0	0	0	0	0	0
Level 1	0	2	0	0	0	0	0	2
Level 2	0	2	0	0	0	0	0	2
Level 3	0	0	0	0	0	0	0	0
Level 4	6	2	0	0	0	0	0	8
Total	6	6	0	0	0	0	0	12

Table 18

Colin - Miscue Analysis - Graded Passages

Pre-Test

Grade	Mis.	Sub.	Ref.	Ins.	Om.	Rep.	Rev.	Total
Primer	0	5	0	1	0	2	1	9
Level 1	0	4	0	1	0	8	0	13
Level 2	1	8	0	1	0	3	0	13
level 3	5	5	1	1	1	0	0	13
Level 4	5	11	0	1	0	2	0	19
Total	11	33	1	5	1	15	1	67

Post-Test

Grade	Mis.	Sub.	Ref.	Ins.	Om.	Rep.	Rev.	Total
Pre-primer	1	0	0	0	1	0	0	2
Primer	4	0	0	1	2	0	0	7
Level 1	0	6	0	2	1	4	0	13
Level 2	0	6	1		2	5	0	14
Level 3	1	11	0	5	1	9	0	27
Level 4	1	21	0	2	2	9	0	35
Level 5	3	28	1	1	2	7	0	42
Level 6	1	18	0	0	1	5	0	25
Total	6	95	2	10	10	42	0	165

graphically similar miscues (85%), with no miscues of partial or low graphic similarity. At post-test the number of highly graphically similar cues decreased substantially (60%), but, again, no partially or low graphically similar cues were noted. These results indicated that Colin relied to a great extent on graphic cues in his reading, and the decrease found in the number of these miscues may have been due to an increased ability to successfully employ graphic word analysis.

Colin obtained a substantial proportion of non-meaningful miscues at both pre-test (50%) and post-test (53%). The proportion of non-meaningful miscues indicated that Colin had difficulty in monitoring for meaning in his reading. He also obtained approximately equivalent numbers of partially meaningful miscues (21% at pre-test, 27% at post-test) and highly meaningful miscues (29% at pre-test, 20% at post-test) at pre-test and post-test. These miscues indicated that Colin attempted to use background knowledge to assist in word identification in his reading. However, he had difficulty monitoring meaning in text.

In summary, Colin appeared to rely to a great extent on graphic cues in his reading. At post-test he obtained fewer graphic miscues than pre-test, indicating an improvement in graphic analysis. This improvement was consistent with the trend towards improvement found in Word Attack on the WRMT-R, and in single word recognition on the Graded Word Lists of the Burns and Roe IRA. While this improvement seems encouraging, it is important to note that Colin was still performing at an instructional level in word recognition that was three years behind his grade level. Therefore, while an improvement is evident in certain aspects of Colin's reading, other areas, such monitoring meaning, may require remediation in order for significant improvements to occur.

Colin's performance in oral comprehension is displayed in Table 19. Substantial improvement was found in oral comprehension, where Colin's highest instructional level increased from grade 3 to grade 4. Improvements of 10% to 30% were also found in

Table 19

Colin - Oral Comprehension - Percentage of Errors

Pre-Test

Grade	M.I.	Det.	Seq.	C./E.	Inf.	Voc.	Total	Level
Primer	0	50	0	NA	50	0	25	Inst.
Level 1	0	0	NA	100	50	50	25	Inst.
Level 2	0	0	0	100	33	100	25	Inst.
Level 3	100	25	100	0	0	50	40	Inst.
Level 4	100	50	0	100	100	100	70	Frust.
Total	40	23	25	75	42	60		

Post-Test

Grade	M.I.	Det.	Seq.	C./E.	Inf.	Voc.	Total	Level
P.Primer	0	33	0	0	0	NA	22.5	Inst.
Primer	0	67	100	0	50	NA	50	Frust.
Level 1	0	33	0	0	0	0	22.5	Inst.
Level 2	100	0	0	0	0	0	22.5	Inst.
Level 3	100	20	0	0	50	0	30	Inst.
Level 4	100	50	100	0	50	0	40	Inst.
Level 5	0	25	0	50	100	100	60	Frust.
Level 6	0	60	100	67	100	0	70	Frust
Total	29	37	36	25	47	20		

percentage of correct responses on equivalent grade levels administered at pre-test and post-test. The main areas of improvement were in questions concerning Cause and Effect, Vocabulary, and Main Idea. These results indicated an improvement in oral comprehension. This improvement may have stemmed from enhanced decoding skills and ability to derive meaning from text.

Colin's pre-test and post-test listening comprehension performance is displayed in Table 20. Like his performance in oral comprehension, Colin's highest Instructional level on this subtest also increased from grade 3 to grade 4. However, a great deal of variability was noted in his performance. For example, on post test Colin obtained a Frustration rating at grade 3, but continued on to obtain an Instructional rating at grade 4 before obtaining Frustration again at grade 5. Further, inconsistency was noted in the types of errors made. At pre-test most errors were made in Inference, Vocabulary, and Sequence. Some errors in Cause and Effect were also noted, and few errors were observed in Main Idea and Detail. At post-test there was a substantial increase in number of errors made in Cause and Effect and Sequence. Several errors were made in Vocabulary, also an increase from pre-test. A decrease from pre-test in Inference errors was noted, and the number of errors in Main Idea and Detail remained low.

Colin's inconsistent performance in listening comprehension suggested that no substantial improvement occurred in this area. The contrast between Colin's inconsistency in listening comprehension and his consistent improvement in oral comprehension indicated that the latter improvement may have been due to an increase in skills specific to reading. Increased ability to decode the words may have resulted in improvement in deriving meaning from test, thus improving oral comprehension. In listening comprehension the ability to read the text was not a factor, therefore improved reading skills could not have aided Colin's performance on this task. Therefore, it was inferred that increased reading skills resulted in improved oral comprehension, but did not improve listening comprehension.

Table 20

Colin - Listening Comprehension - Percentage of Errors

Pre-Test

Grade	M.I.	Det.	Seq.	C./E.	Inf.	Voc.	Total	Level
Level 1	0	100	100	50	0	0	25	Inst.
Level 2	100	0	0	0	100	0	25	Inst.
Level 3	0	0	0	50	100	50	30	Inst.
Level 4	0	25	100	0	50	100	50	Frust.
Total	25	20	50	40	57	50		

Post-Test

Grade	M.I.	Det.	Seq.	C./E.	Inf.	Voc.	Total	Level
Level 2	0	0	100	50	50	0	37.5	Inst.
Level 3	100	40	100	100	0	100	60	Frust.
Level 4	0	0	100	100	0	50	30	Inst.
Level 5	100	50	0	100	50	100	60	Frust.
Total	25	25	80	83	38	71		

Perception of Academic Abilities.

Colin's performance on the PASS is displayed in Table 21. A substantial increase was noted in Colin's overall perception of academic abilities, his Full Scale score increasing by nine points. With the exception of the General Abilities and Arithmetic subscales, improvements were noted in Colin's perception of his performance in all areas. The greatest subscale improvement noted was on Reading/Spelling, where a 5 point increase changed Colin's score from "weak" to "below average". Colin's score on School Satisfaction also changed from "weak" to "below average". Improvements were also noted in Penmanship/Neatness and Confidence, although Colin's perceptions in these areas remained in the "weak" and "average" ranges respectively. It was inferred that, as a result of the intervention, Colin felt more positive about his academic abilities in general, and his reading in particular. This enhanced self-concept may have been due to a perception of increased strategies available to apply to reading.

Dynamic Assessment

Decoding Probes

Colin's performance on decoding probes, measured in seconds per correct response, is displayed in Figure 18. Probes 1, 3, and 5 were composed of words which were used in the intervention at each difficulty level. The difference between first and second administration of these probes indicated improvement due to direct training within the context of the intervention. Probes 2, 4, and 6 were composed of words of the same complexity as probes 1, 3, and 5 respectively, but which were not used in the intervention. Colin's scores on these probes were compared to his post-test scores on 1, 3, and, 5 to determine whether generalization of training occurred.

Table 21

Colin - Performance on Perceptions of Abilities Scale for Students

Subscale	Pre-Test	Post-Test
General Ability	5 below avg.	3 weak
Arithmetic	12 strong	12 strong
Reading/ Spelling	1 weak	6 below avg.
Penmanship/ Neatness	2 weak	4 weak
School Satisfaction	3 weak	5 below avg.
Confidence	3 average	5 average
Full Scale	26 weak	35 weak

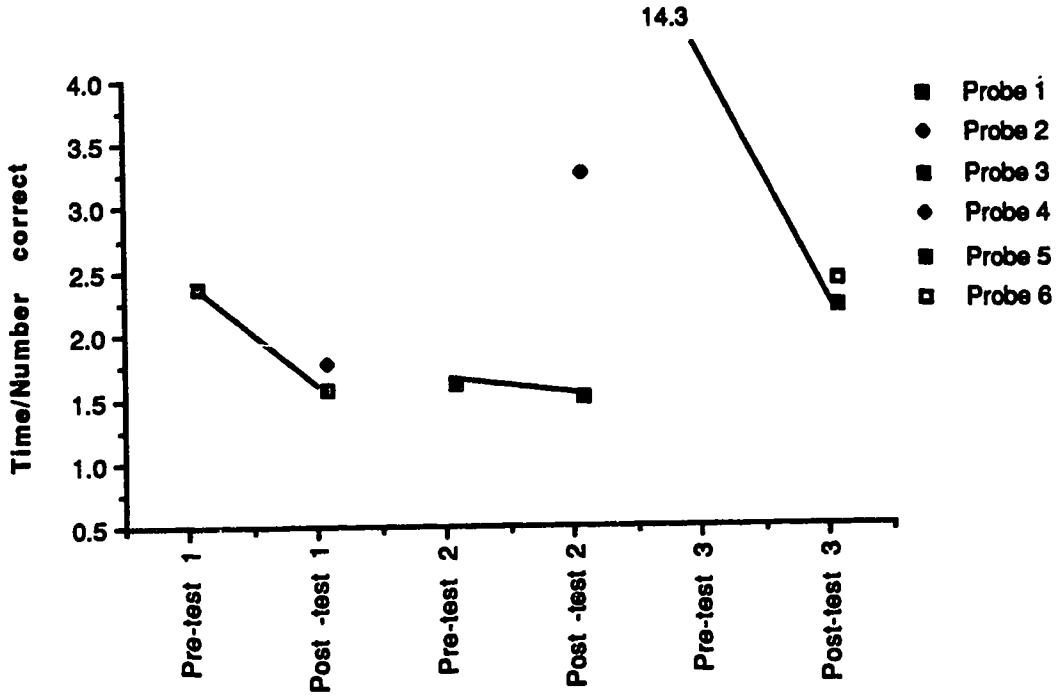

Figure 18. Colin - Decoding probe performance.

Improvement was noted between pre-test and post-test scores for probes 1 and 5, suggesting that improvement occurred as a direct result of training with those words. Minimal improvement was noted on probe 3. However, it is possible that a ceiling effect played a role in Colin's performance on this probe. Colin's performance on probes 2 and 6 closely approximated his performance on the post-test of probes 1 and 5. Since these words were not used in the intervention, it was inferred that these results were due to generalization of decoding strategies to these words. The exception to this pattern was noted in Colin's performance on probe 4, which was substantially higher than his performance on the post-test of Probe 3. This difference may have been due to Colin's attention and motivation at the time the probes were conducted. The lack of improvement between the pre-test and post-test of probe 3 also suggests that Colin may not have been performing to his full potential on that day. In general, however, these probes suggest that the intervention had direct effects on Colin's decoding ability with words that were used during the training, and that these effects transferred to words that were not used during the training.

Intervention - Qualitative Impressions

Colin performed generally well throughout the intervention, which involved approximately 14 hours of work within 2 months. Strategies noted in global tasks included verbalization, rehearsal, scanning, using categories to remember sequences, using colors, patterns, and shapes to match fronts and backs of pictures, and eliminating alternatives. During bridging tasks dominant strategies were sounding, using background knowledge, sound blending, rehearsal, predicting and revising, tracing with finger, and scanning. Colin had most difficulty in blending sounds together to form words. He would often insert additional sounds into the words, possibly in an attempt to make them sound more like a known word. He also had difficulty remembering series of letters. This appeared to be particularly true when he did not have the opportunity to

see words in their entirety, and was required to hold the letters separately in short-term memory and synthesize them into words without the aid of a model.

Related Memory Set. Colin had no difficulty with the global portion of this task, and was able to achieve 100% accuracy on all levels. He used colors, patterns, and shapes to match backs and fronts of animals. He also used his background knowledge of animals.

On the bridging part of this task Colin did well with level 1, although no particular strategy use was apparent. With level 2, however, he used sounding and checking alternatives to respond. He had difficulty with this level in blending the sounds together to form the words, and required three trials to reach criterion before proceeding to the next level.

Joining Shapes. On the first levels of this global task, where instructions were given one at a time, no overt strategy use was apparent. Colin's only difficulty was determining where to start, but soon he understood that the starting point often changed. When instructions increased to two at a time he started to use rehearsal, but not extensively. At three instructions he repeated instructions under his breath as they were said and traced the pattern with his fingers in the air. He often had difficulty remembering the third instruction, as inferred by frequent hesitation before responding. Colin managed to maintain a high level of performance on all difficulty levels.

At the first level of this bridging task Colin used sounding to determine the words. He had some difficulty with sounding when he did not immediately recognize the word, and seemed to have difficulty blending the sounds together. He would use a technique of repeating and revising to determine words, but would also add extra sounds in an apparent attempt to make the word sound like a word that he knew. He was quite unsure

of himself, and looked to the instructor for clues as to whether he had responded correctly. On the second level Colin appeared more comfortable with the task. He often used the rules to determine the second letter of a word, and then scanned ahead to try to determine the rest. He also rotated the page in an attempt to "see" the words. His score on the second level was higher than the first. On the third level these strategies were also used, but Colin had difficulty sounding and blending. After several attempts he began to lose interest, and needed encouragement. Consequently, he did not meet criterion, and required another session at the third level. Since there were no alternate stimuli available at this level, the same stimuli were used again, possibly causing a practice effect. He used sounding and was able to "see" the pattern among the letters.

Transportation Matrices. Colin found the global component of this task very easy, and was able to maintain 100% accuracy throughout the intervention. He used some verbalizing, but no extensive strategy use was apparent.

On the bridging portion of this task Colin had some difficulty on the first level in blending the sounds together, and seemed rather impulsive on his initial response to the words. However, viewing the letters one at a time seemed to assist him in sounding out and modifying his initial response. On the second level he also had some difficulty in sounding , but was able to revise his responses. On the third level the cells seemed to help him in determining whether his answer was correct (eg. enough letters). He used a great deal of sounding to determine and remember the words.

Connecting Letters. On the first level of the global portion Colin used the colors of the lines to match the letters. At the second level he became confused at some of the intersections of the lines. At the third level he was not allowed to use his finger tc follow the line, and hence did a great deal of scanning. He maintained a high level of performance throughout this task.

On the bridging task Colin had some difficulty blending sounds together at level 1. He was somewhat impulsive, and was constantly trying alternatives. At level 2 he also required some assistance to blend sounds together, and did not reach criterion. He did reach criterion on the next session, and used sounding and blending under his breath. At level 3 Colin also used sounding and blending. He had difficulties with the longer words, however, and again did not meet criterion at this level. On the next session Colin made a greater effort to sound out and synthesize sounds. He would often sound parts of a word separately and then try to synthesize them together, and often made predictions based on the first part of the word. His performance improved substantially on this level.

Serial Recall. Colin found the first level of this global task very easy, although he used a great deal of rehearsal. He also displayed good performance on the second level, using verbalization and rehearsal. On level three he had some difficulty, often reversing the sequence of two or more pictures. He used categories to remember the sequence, but only after it had been mentioned by the teacher. Colin also used a strategy of elimination, where he would place the first and last picture of the sequence, and then infer the placement of the other pictures.

Colin performed well on the first level of the bridging task, with few difficulties in sounding. He traced the letters on the desk with his finger to remember the sequence. On the second level he had some difficulty sounding the longer words, and said he did not know some of the words. At level three he used a great deal of rehearsal and sounding under his breath. He also divided some words, finding smaller words within, to assist him with sounding.

Window Sequencing. On the global task, Colin used rehearsal to remember sequences at level 1, and only had minor difficulty with the longer sequences. At level 2 he used some rehearsal. However, he was not in a good mood that day and did not put

forth his maximum effort. He did not reach criterion at that level. He performed much better on the next session, using rehearsal and verbalizing. He said he was "really paying attention this time". At level 3 he also used verbalizing and rehearsal. He seemed to rely on color patterns rather than shapes. He also appeared to be using a holistic type of strategy to solve the items; laying all the chips out first, then putting them in a tentative order, then revising until he thought it was right. He seemed to combine this strategy with verbalizing. He also used the elimination strategy mentioned earlier.

On the bridging task, Colin performed well on level 1, rehearsing and sounding under his breath. He had some difficulties in sounding. On level 2 he also used sounding, but found some of the words with silent letters difficult. At level 3 he used a great deal of sounding. Sometimes he didn't know the word until he had spelled it out completely, at which time he would blend or recognize it. Sometimes he was very confused as to what the word was by viewing the letters separately, and his reproduction would not resemble the word in any way. It appeared that the lack of recognition of the word, or at least a hypothesis as to what the word was, left Colin without an organizational framework. This placed a greater tax on memory, and, therefore, Colin found it difficult to reproduce the word. He did not meet criterion at this level. On the next session he also used sounding and synthesizing. Again, he often did not know the word until he spelled it out., and often confused the order of letters in words he did not recognize. If he was able to spell words he would use sounding and predicting.

After the intervention Colin discussed with the teacher the possible benefits of the training and how it related to reading. Colin said that generally the training helped him to sound and to understand words and stories better. He also said it helped him in remembering the order of things, such as teacher's instructions and remembering the spelling of words.

Summary

An examination of Colin's CAS performance revealed that the only significant improvement observed was on a successive processing task, Speech Rate. A trend towards improvement was also noted in Successive Word Recall. These improvements, coupled with the lack of improvement found on simultaneous processing, attention, and planning tasks, suggested that specific improvement occurred in successive processing. From these results it was inferred that the intervention contributed to improvement in successive processing, thus supporting Hypothesis 1.

In reading, a trend towards improvement was noted in Word Attack, suggesting that the intervention may have contributed to an increase in word analysis skills. However, the lack of improvement noted in Word Identification suggested that this improvement did not transfer to word recognition. On the Burns and Roe IRA, an improvement in the number of words that Colin read correctly on the Graded Word Lists indicated an improvement in single word reading, although this improvement was not sufficient to result in an increase in Instructional grade level.

On Grade Passages of the IRA, an examination of miscues indicated that Colin relied heavily on graphic analysis to read words. Although Colin's word recognition reached Instructional level at the same grades at pre-test and post-test, miscues involving high graphic similarity decreased substantially. This observation suggested that the intervention improved Colin's performance in graphic word analysis, a previously preferred strategy, thus allowing him to use this strategy more effectively. Further, improvement found in oral comprehension, in contrast with little improvement in listening comprehension, suggested an improvement in deriving information from text. From these results it was inferred that the intervention did improve word analysis skills, and that this improvement resulted in an improvement in deriving information from text, thus increasing performance in oral comprehension.

An examination of Colin's performance on the decoding probes provided a dynamic measure of improvement in decoding skills. His performance on probes 1 and 5 suggested improvement for known words used in training. Improvement on probes 2 and 6 indicating generalization of training to words not used in the intervention. These results also indicated that the intervention resulted in improvements in decoding skills.

On the PASS Colin displayed substantial improvement in perception of abilities in Reading/Spelling and School Satisfaction. This indicated that Colin felt more confident about his reading ability and general school performance. This increased confidence may have been due to his perception of increased strategies with which to cope with school work.

In general, Colin's results suggested that the intervention improved his successive processing, his decoding, and his perception of his academic abilities. However, inconsistencies in performance on some tasks, behavioral indications of distraction during intervention, and teacher and parent reports of attentional difficulties, indicate that attentional factors may also have affected Colin's performance. Despite these difficulties, however, the trends from several data sources suggested that improvement in successive processing and basic decoding skills did occur as a result of the intervention.

CHAPTER IV - DISCUSSION

The data presented in these cases provide some evidence for the benefit of CAP training in improving successive processing and decoding skills in HPLD children. Although the results were not consistent, each child displayed significant change on one or more of the measures conducted. The nature of these changes, as well as behavioral observations of the children during the intervention, provide insights into the strengths and weaknesses of CAP training, thus indicating directions for further research and development of the remedial model. In the following sections these results will be discussed in terms of a) the methods used in the present study to measure change, b) facilitating transfer with the CAP program, and c) the individuality of the learning difficulties experienced by children.

Measurement of Change

Several sources of data were collected in the present study in an attempt to measure change in cognitive processing, reading, and perception of academic abilities. The inconsistencies in performance noted within each child may have been due, in part, to limitations of specific instruments in terms of their reliability and accuracy in measuring these variables. Further, there are general measurement issues to be considered when examining the present data.

Assessment Instruments

Each of the instruments used in the present study possessed some shortcomings in design. As a result, they may not have adequately measured change in performance, thus resulting in a distorted view of the children's abilities and, consequently, the effectiveness of the intervention.

The instrument for measuring cognitive processing was the Cognitive Assessment System (CAS). The successive and simultaneous processing tasks within the CAS battery have been found to load on separate factors in factor analytic studies (Naglieri, 1989), suggesting that these tasks measure distinct processes. However, a limitation of the CAS, as used in the present study, concerns the norms against which the students' performances were compared. These norms are based on a small number of children from a specific geographical area, and, therefore, may not be representative of the actual processing abilities of the general population. Further, since the present study examined a special population (HPLD), it is possible that a special norm group (eg. high IQ) may have provided a more appropriate comparison. However, since no other norms were available against which to compare single subjects, the present norms provided the best possible comparison. Research is currently being conducted for the purpose of establishing more appropriate norms for CAS tasks, and will provide valuable information for future remedial research.

The instrument used in the present study to provide a standardized measure of reading ability was the Woodcock Reading Mastery Test-Revised (WRMT-R). This is a comprehensive test, providing subtests for several components of reading. However, the subtest and cluster scores on the WRMT-R provided only global estimates of abilities in decoding and comprehension. This, of course, is a shortcoming of all standardized tests which yield normative scores. As a result of this drawback, WRMT-R scores may not have been sufficiently sensitive to detect subtle changes in reading skill.

Another shortcoming of this test involved the measurement of reading in the context of passages. While the WRMT-R provided four subtests that measured decoding and comprehension of words in isolation, only one subtest, Passage Comprehension, involved reading passages. Further, this subtest involved only silent reading, and therefore did not provide a measure the students' proficiency in oral reading. Finally, the comprehension measure provided by this subtest was based on a single-word cloze

task, thus not revealing the nature of the students' strengths and weaknesses in comprehension. Therefore, the WRMT-R did not provide a comprehensive measure of the students' ability to read passages or derive meaning from text.

A final shortcoming of the WRMT-R involved the absence of qualitative measures of reading. The Burns and Roe IRA was administered to compensate for this shortcoming by providing qualitative measures of word recognition and comprehension. However, a drawback of this test, as used in the present study, involved the nature of the Graded Passages. Because a single passage was used at each grade level to determine word recognition or comprehension, the nature of the specific material in the passage may have interacted with the child's own background knowledge to enhance or depress performance, thus providing a distorted measure of reading ability. The fluctuations noted from grade level to grade level in word recognition and comprehension, as well as the inconsistencies between equivalent passages administered at pre-test and post-test, supported this hypothesis. The average of the student's performance on several passages at the same grade level may have provided a more reliable measure of his/her ability. However, while four alternate forms were available at each grade level, the design of the study did not permit the use of more than one passage for each subtest. Graded Passages were used to determine both oral comprehension and listening comprehension, and each subtest required an alternate form for pre-test and post-test. Therefore, no alternate forms were available to check the reliability of the students' performance on each subtest.

The instrument for measuring academic self-concept, the Perception of Abilities Scale for Students (PASS), is a seventy item true/false questionnaire. Because it is a forced choice questionnaire, it suffers from the common drawback of all forced choice questionnaires in that it may distort the child's true feelings. Specifically, the questions asked the students may not have provided an accurate representation of their perceptions about school because they required a definite "yes" or "no" answer. For example, if the

student did not have a strong opinion regarding a statement such as "I am good at reading.", then any response given would have underestimated or overestimated the child's self-concept. Another shortcoming of the questionnaire is that the children may have been answering in the manner that they felt that the instructor wanted them to answer. This "socially desirable" manner of answering may have artificially raised the children's PASS scores

In summary, all of the instruments used in the present study have some drawbacks which may have masked the true nature of the results and contributed to the observed inconsistencies in performance. However, the aggregation of data from different perspectives was used to compensate for the drawbacks of any single instrument, and provided a more comprehensive view of the student's performance than was possible with each instrument alone. Using multiple perspectives served to increase the validity of the inferences made by providing supporting evidence from several sources.

General Considerations in Measuring Change

When examining the results of the present study, one must also be cognizant of some general considerations involving the measurement of change with special students. One consideration involves the nature of the children in the study, all of whom possessed very low scores on reading tests. When measuring change in children with extreme scores, regression to the mean is a common phenomenon, and stems from the reliability of the instruments used. All assessment instruments contain some measurement error. It is likely, therefore, that such error contributed, in part, to the extreme scores observed at pre-test. Upon post-test it is less likely that the error that contributed to the first extreme score will affect the second score in the same way, thus resulting in scores which are closer to the mean due to error factors alone. Therefore, since the students in the present study obtained significantly below average reading scores, this

phenomenon may have influenced the results. For example, Colin, who displayed the greatest gap between measured reading performance and actual grade placement, also demonstrated the greatest gains in reading skills. However, his scores may have improved without intervention due to regression alone. Therefore, it is important to interpret these results cautiously, and conduct replication research in order increase the validity of the present results.

Another consideration when measuring change involves the "normal" amount of change expected over a given period of time without special intervention. Since there was no control group in the present study, it was not possible to determine to what extent similar children would have improved had they not been involved in the intervention. This raises the issue of whether the changes observed were greater than normally expected for that time frame. This issue may be addressed from two perspectives. The first method involves a comparison of the actual intervention time to the normative differences observed. The intervention required approximately two months to complete. Therefore, changes which represented normative differences of greater than two months can be inferred to have resulted from the intervention. Since many of the observed normative improvements did exceed the time frame of the intervention, it can be inferred that real change did occur.

The changes observed during the intervention can also be compared to a less stringent criterion. The children in the present study all experienced severe delays in reading, and have historically not progressed at a normal rate through school. Therefore, even "normal" improvement can be viewed as significant, as it represents a substantial departure from the usual rate of improvement observed in these children. The observation of "normal" change in the students in the present study may still suggest that the intervention did affect performance.

The aforementioned general and specific measurement considerations provide important implications for further remedial research. First, the instruments used to

measure change, especially over such a short time frame as the present study, must be sufficiently sensitive and comprehensive to provide an accurate and meaningful measure of performance. An approach which incorporates multiple perspectives, obtained by aggregating data from different sources, can provide such accuracy and lend validity to inferences based on the results. Further, criteria must be established as to what constitutes significant change prior to experimentation. These criteria must be established while remaining cognizant of the ways in which such data can be distorted, and take into account the previous rate of improvement in the performance of the children being studied.

Facilitating Transfer with the CAP Model

As discussed earlier, the ultimate purpose of any remedial program is to improve specific academic skills. In the CAP model, a global strategy training method is used to provide children the opportunity to internalize strategies in their own way, thus maximizing generalization. However, global process or strategy training models have historically met with little success in improving academic skills. The two main reasons for this lack of success have involved a) the tenuous link between the process constructs and academic skills, and b) the difficulty experienced by children in applying the strategies to academic domains. The CAP has attempted to improve on these limitations by a) providing training in strategies which have been shown to relate to academic skills, and b) highlighting the application of the strategies to academic tasks through verbal mediation and bridging tasks.

The present results have indicated, however, that while global training may result in improvements in successive processing, it is difficult to "bridge" such training to decoding skills. One reason for this difficulty may be that the CAP bridging tasks, designed to involve successive processes felt to be important in decoding, may not have been presented in such a manner as to consider other important reading processes. For

example, in Joining Shapes letters for each word were placed at various positions among distractors, and not in distinct word units in left-to-right order. In Connecting Letters, the letters in each word were also scattered about the page, connected only by lines. In Window Sequencing the letters were presented one at a time, or in small groups, through a window. Therefore, student did not have the opportunity to see the words in their entirety. While these tasks did involve important decoding skills, such as visual scanning, sound blending, and sequential short-term memory, the manner in which the tasks were presented may not have taken into account other processes that are also important in decoding, such as visual and phonetic synthesis of letters into words or use of background knowledge. Because of this focus on specific skills, the training may not have had the maximum impact on reading. In Colin's case, for example, the training improved specific decoding skills, but did not result in a significant increase in his word recognition Instructional level. The nature of his miscues suggested that other processes, such as monitoring for meaning, may have been more central to improving Colin's word recognition.

Another drawback related to the presentation of the CAP tasks concerns the nature of successive processes as they are involved in decoding in comparison to how they were trained. Since these successive processes were trained in relative isolation, they may not have taken on the same meaning to the students as they would when incorporated into the reading process. Decoding involves a variety of different processes, both successive, simultaneous, and others. To isolate and train one or more specific processes may serve to improve these processes, but may distort their relationship to reading. For this reason, the students may not have been able to make the conceptual step to applying these skills to everyday reading tasks.

Another reason for the limited improvement in decoding is that decoding deficiencies in these children may have been resistant to improvement. This is an issue raised previously with respect to psycholinguistic training (Arter & Jenkins, 1979).

While previous CAP studies (Brailsford et al., 1984; Kaufman, 1978; Krywaniuk, 1974) have suggested that weak global processes can be improved, subsequent improvements in specific academic skills may not be equally amenable to training. Therefore, if the children in the present study possessed specific cognitive dysfunctions related to decoding , then such training may not have been able to produce transfer to this area. It may be necessary, therefore, for training to also provide the student with compensatory strategies for overcoming such weaknesses, such as training simultaneous processing skills, sight-word vocabulary, or comprehension monitoring strategies. In other words, direct training of weak processes may only result in increases in performance in areas where specific cognitive dysfunctions do not inhibit improvement.

Besides specific cognitive dysfunctions, another factor that may have inhibited the performance of the children in the present study was the influence of non-cognitive factors such as attention and motivation. Previous research has indicated that attentional and motivational factors frequently accentuate the difficulties experienced by learning disabled children. This phenomenon has been named "reciprocal causation" (Stanovich, 1986), and refers to instances in which a specific learning disability causes experiences of failure in school, thus creating motivational problems which, in turn, create further academic difficulties, eventually manifesting in a general deficit in all areas. Research with HPLD children has also suggested that low perception of abilities, high frustration, and low motivation are common, and may interact with specific learning difficulties to depress achievement (Waldron et al., 1987). Given these research findings, it is not surprising to discover that the students in the present study also appeared to suffer from attentional and motivational problems. Inconsistencies in task performance and behavioral observations of distraction suggested that attentional and motivational factors played a major role in the students' performance both during assessments and intervention.

The attentional and motivational difficulties demonstrated by the students in the present study highlight certain pre-requisites of any successful remedial program. In order for a child to derive maximum benefit from any type of training, two criteria must be met. First, children must attend to the instructions and, second, they must be sufficiently motivated to learn the concepts being taught. Therefore, in order for CAP training to be successful, it must take these factors into account. The CAP process training should be combined with programming aimed at improving self-concept, attention to task, and motivation to learn. In this way the student will be more receptive to internalizing the principles being taught, and will be more likely to utilize these principles in academic work.

The issues raised concerning the effectiveness of CAP training in facilitating academic transfer provide directions for further research. A limitation of this training in the present study concerned facilitating transfer to decoding. Although previous research suggests that reading skills are related to successive processing (Das & Cummings, 1977; Hooper & Hynd, 1986; Solan, 1987) and that training in successive processing can improve reading (Brailsford et al., 1984; Kaufman, 1978; Krywaniuk, 1974), the present research suggests that this training may not be sufficient to result in significant improvement in reading skill. One factor that has likely contributed to the small magnitude of change observed was the short duration of training. Future attempts to use this model should, therefore, provide training over longer periods to ensure that the maximum possible benefit is derived from the intervention. Another issue concerns the relationship between successive processing, as trained in the CAP tasks, and actual decoding skills. Further qualitative research is required to examine the exact nature of this relationship so that training can be developed which is consistent with reading processes. Future remedial research using this model should also attempt to incorporate other processes which are known to relate to reading in order to more closely approximate the actual reading process and facilitate transfer. Incorporating multiple

processing strategies may also provide compensatory routes for children who possess specific decoding deficits that are resistant to remediation. Finally, the CAP model should consider non-cognitive factors, such as attention and motivation, in the remedial program.

The Individuality of Children's Learning Difficulties

Despite the shortcomings in the methods chosen to measure change, as well as in the limitations of the CAP method in facilitating transfer to decoding, significant change was noted on one or more variables with each of the students who took part in the intervention. However, even though the children were chosen for the present study on the basis of similar intellectual potential, cognitive functioning, reading skill, age, and gender, they displayed differences in the nature of their improvements. The differences noted between these children has served to illuminate some important issues with respect to the individuality of learning problems. Traditionally, group designs have been the preferred method in intervention research. A major assumption made in these types of designs is that all children in a certain group are relatively homogeneous, and therefore will benefit similarly from a specific intervention. Perhaps the most important finding in the present research was that the effects of the training manifested differently in each student. This finding indicated that, while the training did have marked effects, the nature of the effect was dependent on the unique characteristics of each child.

In the first case, Brian, improvement was found in successive processing skills as measured by the CAS, but not on any of the reading tasks. Decoding probes indicated that the intervention improved decoding skills only with words that were used in the intervention, and did not transfer to words not used in the intervention. Brian did show considerable improvement, however, in listening comprehension. It was inferred that,

since listening comprehension also includes a component of successive processing, that the intervention may have contributed to this improvement.

Several factors may be cited in Brain's case as possible reasons for the lack of transfer to reading. First, the intensity or duration of the intervention may not have been sufficient to result in generalization to reading. Also, specific deficits in decoding may have inhibited intervention from being effective in this area. Finally, Brian's preferred reading strategies may not have been consistent with the successive strategies promoted in training. An examination of Brian's miscues indicated that he used graphic analysis (a successive strategy) and background knowledge (a simultaneous strategy) to a similar extent in word recognition. Therefore, he may not have made the inferential step of applying the successive strategies promoted in the intervention to reading. In short, Brian's results indicated that training did improve successive processing. This improvement, however, did not transfer to reading, but manifested in improvement in listening comprehension.

Mathew, the second case, possessed the highest reading skill of the three children, and demonstrated the best performance throughout the intervention. He did not improve in his performance on successive processing tasks, although some improvement was noted on one planning task. It was inferred that, since many of the strategies which were promoted during the intervention could have been applied to this planning task, that some generalization of strategies did occur. However, Mathew did not display improvement in reading ability as measured by any of the reading tests, and decoding probes showed improvement only for words used in the intervention. In contrast, improvement was noted in Mathew's perception of his reading skills. It is possible that his excellent performance in the intervention was encouraging, and changed his perception, but not his ability, in reading. It was hypothesized that he may not have been sufficiently challenged by the intervention to cause improvement in reading.

Sufficient challenge is a necessary requirement in order for the student to internalize and generalize successive processing strategies (Das & Conway, in press).

Mathew's results also indicated he used graphic analysis and background knowledge to a similar extent in his reading. Therefore, his preferred decoding strategies may not have been amenable to adopting the successive, analytic reading style promoted in the intervention Improvement was noted, however, in his ability to use background knowledge to assist in word recognition, but this improvement did not result in significant change in this ability.

Evidence suggested, however, that Mathew may have applied the successive strategies promoted in the intervention to academic areas other than reading. He stated during the intervention that he felt the training was "useful". However, his explanation of usefulness did not involve reading, but instead referred to remembering series of instructions given by the teacher or details presented in a lesson. Therefore, although the intervention did not generalize to the successive tasks or reading, it may have resulted in some improvement in certain successive strategies, as well as their application to other academic areas. This improvement may have, in turn, resulted in improved perception of abilities.

Colin, the third student, possessed the lowest reading achievement of the three students, and had some difficulty with the intervention tasks, but appeared to derive the greatest benefit from successive training. He displayed improvements in successive processing tasks, improvement which approached significance on the Word Attack subtest of the WRMT-R, a trend toward improvement in word recognition performance in Graded Word Lists, and improvement in oral comprehension on the Burns and Roe IRA. Colin also displayed improved perception of abilities in reading on the PASS. Further, unlike the other two students, Colin demonstrated improved performance on decoding probes containing words that were used in the intervention as well as words that were

not used in the intervention. The combination of these factors indicated that Colin did benefit from the intervention in terms of successive processing and decoding.

An examination of Colin's miscues indicated an improvement from pre-test to post-test in graphic word analysis, which appeared to be his preferred reading strategy. Since graphic word analysis is highly successive in nature, it was inferred that the intervention contributed to this improvement. In other words, Colin's previous reading strategies may have been consistent with the type of strategies promoted in the intervention. Therefore, training may have assisted him in using these strategies more effectively, thus improving reading performance. However, this improvement did not result in an overall increase in Colin's ability in word recognition, which remained approximately three years behind his present grade level. This indicated that other factors, such as monitoring meaning, may have required training in order to affect further improvement in Colin's reading.

The differences in performance between the three children highlights the individuality of children's processing and reading abilities, even within HPLD students. Mathew and Brian did not appear to benefit greatly from the intervention in terms of decoding skills, but did show change in other areas. However, the differences in the nature of these changes indicated that the intervention interacted with their own cognitive processes and background knowledge to manifest itself in unique ways within each student. For Colin, his level of reading ability, as well as his specific strengths and weaknesses, may have interacted with the nature of the intervention tasks to produce an improvement in successive processing, reading, and perception of abilities.

One possible characteristic that interacted with the training involved the preferred reading strategies of the students. Colin appeared to rely on graphic word analysis to a greater extent than Mathew or Brian, indicating that a reading style which relies more on graphic word analysis may be more amenable to training in successive processing. However, the lack of overall improvement in Colin's overall word

recognition level also indicated that training in other areas, such as monitoring meaning, are also important if intervention is to ameliorate overall reading skill.

In summary, the present study indicated that CAP training can improve successive processing and decoding skills in HPLD children. Inconsistencies in performance were noted, however, both within and between students. It is important, therefore, for future research to investigate other factors, both within the student and the intervention, that may affect the outcomes of such training.

Further refinement of the CAP model is required in order to increase the effectiveness of such training in improving decoding skills. Training programs which are longer in duration should be conducted in order to maximize students opportunity to internalize principles and generalize them to reading. Qualitative studies, examining the exact nature of the relationship between successive processing and decoding, are necessary in order to develop effective bridging tasks. Other processes involved in reading should be included with successive processing in CAP training so that processes are not trained in isolation, thus making the intervention more consistent with actual reading. Finally, non-cognitive factors, such as attention and motivation, must also be considered when implementing such a remedial program.

Differences between students is also an important consideration if the CAP model is to be successful. The finding that each child reacted differently to the training highlights the individuality of specific learning problems possessed by students. One factor that appears to relate to the effectiveness of intervention is how challenging the tasks are to the student, for if they are not challenging the student may not use the appropriate strategies and internalize them into his/her own cognitive organization. Other factors, such as the preferred reading strategies of the student, the ability to learn inferentially, and specific cognitive strengths and weaknesses, may also affect the outcomes of intervention. One reading strategy that appears to be amenable to successive training is reliance on graphic word analysis. The relative importance of such factors

requires further investigation in order to produce remedial training which is sufficiently flexible to meet the needs of a variety of students.

In order to examine the aforementioned factors effectively, research must move away from the traditional group design to more comprehensive case study investigation. This type of approach will allow an in-depth, qualitative analysis of the relationship between simultaneous and successive processing and specific reading skills. Utilizing this type of research design will assist special educators in understanding the cognitive processes involved in reading, learning, and learning disabilities. This will, in turn, promote the development of effective programs with which to assist children in overcoming such disabilities.

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APPENDIX A - Parental and Student Consent

Dear Parent:

I am a graduate student conducting research for my Master's thesis in Educational Psychology at the University of Alberta. The focus of my research is teaching processing strategies in order to improve performance in reading. The population I wish to study are children who display high intellectual potential, but who are still experiencing reading problems. Through previous assessment, which was conducted with your child last year, it has been discovered that your son,_____, meets the criteria for my subject selection. I would therefore like to request your permission that he be allowed to participate in this study.

There are many suggested reasons for academic difficulty in elementary aged students. Many recent approaches to assessment and remediation of reading difficulties are focussing upon strategies for learning rather than academic content per se. When a child is given some new approaches to assist him/her in taking in new information and solving problems these unique strategies can apply to many academic areas.

Previous studies have suggested that difficulties in reading among children with high intellectual potential may be related to limited ability to process information in a sequential fashion. This study will therefore attempt to teach sequential processing strategies and how to apply them to reading.

The study will involve up to twelve hours of remediation, which will be conducted during school time. The children will initially perform cognitive tasks which are non-academic in nature and game-like in design, and which have proven highly motivating to students in past studies. The techniques learned while performing these tasks will then be applied to reading words, thus providing your child with strategies which may be helpful in reading at school. From time to time sessions, or parts of sessions, may be audio or video taped. A replay of these tapes may allow me to see behaviors and hear comments which I may have missed during the session. These tapes may also be viewed by one or more academic staff for the purposes of explaining the research results.

Results of the study, including data on intellectual potential, cognitive processing, and reading ability, will be prepared for the school and parents. Teachers may make use of this information to assist in further remedial planning as is appropriate. To preserve anonymity of subjects, in no cases will the data for an individual child be identified other than by a code number. Also, you and/or your child will be free to opt out of all or part of the program at any time. I hope that your child will participate in what I feel is an exciting and worthwhile research project.

For further information you are welcome to call myself or my thesis advisor, Dr. Fern Snart. Please return this form as soon as possible to the teacher, and thank your in advance for your cooperation.

Dr. Fern Snart
Associate Professor
Educational Psychology
492-1145

Shawn Crawford
Graduate Student
Educational Psychology
433-3743
492-4505

Date: _____

Child's Name: _____
Classroom Teacher: _____

PLEASE CHECK ONE:

_____ my child may participate in the research project.
_____ I would rather my child NOT participate in this project.

Signature: _____

Description of Project to Students

I'm a student going to the University and I was here last year doing some testing. Do you remember when I was here? Well, from the testing we did we put together a new way of helping students with reading. This method has never been tried before, and I want to find out how well it works by trying it out with a few students. Our testing from last year showed us that this type of training should work especially well in helping you with your reading, so I would like you to work on this project with me if you want.

Here's how it would work. First, I would give you some more tests to get a better idea of how you read. Then we would work on the project together in school time. We would work on it for about 40 minutes each day for about 1 month. The tests that we work on will be alot like the ones you did last year. There will be several parts. Sometimes you will be drawing things, or copying things, or putting puzzles together. Sometimes we will work with words, and sometimes we won't. We will talk about how you did the tests, how you might do them so they would be easier, and how some of the same things that you did might help in reading. Sometimes I will tape us with a video camera to make sure that I'm doing everything right.

In this project you won't have to do any homework, and you won't be graded on it for school. If you decide to try it, and later you find out that you really don't like it, you can tell me or your parents and we will stop the project. Do you have any questions?

APPENDIX B - Description of CAS Assessment Tasks.

1. Speech Rate

Purpose-The student is presented a card on which three words are printed in a single row. The three words are one, two, or three syllables long, and the student is required to repeat these words ten times as quickly as possible.

Focus-successive-speed of decoding and verbal output, sequential ordering.

Materials

1. 6 cards, two with one syllable words, two with two syllable words, and two with three syllable words.
2. Stopwatch
3. Record form

Administration

1. Give stimuli card to student.
2. Present Items 1 to 6 in the following order : One card with 1 syllable words, one card with 2 syllable words, one card with 3 syllable words, repeat.
3. The student is to repeat the words 10 times for each card.
4. Begin timing as soon as the student states the first word. Stop timing after the last word of the tenth repetition.
5. Record time for each card individually.

2. Successive Word Recall

Purpose-The student is verbally presented with a series of one syllable words. After the examiner says the words,the student's task is to repeat the series in the same order.

Focus-successive-verbal auditory recall of verbal information.

Materials

1. Record form

2. Stopwatch

Administration

1. Present words at rate of one per second.

2. Score each item as Pass (all items correct) or fail (some items incorrect) 0 or 1.

3. Score 1 for each correct word in a series.

4. Discontinue after 4 consecutive failures.

3. Naming Time

Purpose-The student is presented with a list of thirty words printed on a single page. The student's task is to read all of the words on the page as quickly as possible. The student is required to read from right to left on each row of words, without stopping. Three such pages are presented.

Focus-successive-speed of verbal output, successive word analysis.

Materials

1. 3 stimuli sheets

2. Stopwatch

3. Record form.

Administration

1. Place stimulus page in front of student.

2. Present pages in numbered order.

3. Begin timing as soon as student says first word and stop as soon as student says last word.

4. Record time for each page separately.

4 Figure Memory

Purpose-The student is presented with a geometric figure drawn on a 3 x 3 card. The figure is presented for five seconds, and then removed. The student is then presented

with a page in which the same geometric figure is embedded within a more complex design. The student's task is to find the figure within the larger design, and trace over the figure with a red pencil.

Focus-**simultaneous**-figure-ground relationships, spatial memory.

Materials

1. Standard cards
2. Response page
3. Red pencil with eraser
4. Record form

Administration

1. Expose stimulus card for 5 seconds.
2. Expose response page after stimulus card is removed
3. Score pass for perfect reproduction of figure. A failure is recorded for any deviation from the original figure
4. Discontinue after four consecutive failures.

6. Simultaneous Verbal

Purpose-The student is presented with a page containing six numbered pictures. At the bottom of the page is a question, such as "Which picture shows the boy in front of the man?" The student's task is to point to, or say the number of, the picture which corresponds to the question. The student must respond as quickly as possible. Twenty six items are individually presented.

Focus-**simultaneous**-spatial relationships, attention to visual detail.

Materials

1. Stimulus notebook
2. Record form
3. Stopwatch

Administration

1. Administer all items.
2. Read each statement to student.
3. Read each item a maximum of three times.
4. Record time from exposure of page to response. Time limit is 90 seconds. Record time for each item individually.
5. The student's score on this task is determined by dividing the total time for the completion of the twenty six items by the number of correct responses, to provide a score of number of seconds required for each correct response.

7. Selective Attention Expressive

Purpose-This task consists of three parts. In the first part the student is presented with a page containing forty color words, and is required to read the color words by rows from left to right across a page as quickly as possible. In the second part the student is presented with a page containing forty color bars, and is required to name the color of the bars in the same manner. In the third part the student is presented with a page containing forty color words, each printed in a different color of ink. The color of the ink does not correspond to the word. Here the student is required to name the color of the ink which color words are printed in.

Focus-attention-expressive selective attention of visual information.

Materials

1. 6 stimulus cards
2. Stopwatch
3. Record form

Administration

1. Record time to complete each page. Allow a maximum of 3 minutes.

2. Start timing when student says first word and finish timing when student says last word.

3. Record time for each page individually.

4. Record the number of correct responses on each page.

8. Selective Attention Receptive

Purpose-This task consists of two parts. In the first part the student is presented with a page containing several rows of letter pairs, and is required to underline the pairs of letters which look exactly the same (eg. TT, ss). In the second part the subject is presented with a similar page, and is required to underline pairs of stimuli which have the same name (eg. Tt, sS).

Focus-attention-receptive selective attention of visual stimuli.

Materials

1. Response sheets
2. Pencil
3. Stopwatch
4. Record form

Administration

1. Instruct student to work row by row, from left to right.
2. Record time for each sheet. Time limit is 3 minutes.
3. The score for the student is determined by dividing the time required to complete the page (in seconds) by the total number of correct responses, to provide a score in number of seconds for a correct response.

9. Crack the Code

Purpose-The student is presented with a sheet containing pictures of several rows of colored chips. Beside each row there is a statement detailing how many of the chips are

in the correct place in the row, but not which chips are in the correct place. The student's task is to determine the correct sequence of colored chips by examining the previous rows of chips and how many chips are correct in each row. The student is provided with set of chips of the appropriate number and color, and is required to place them in blank spaces at the bottom of the page as quickly as possible.

Focus-**planning**-organizing sequence and color in order to produce the correct code.

Material

1. Stimulus sheets
2. Colored chips
3. Stopwatch
4. Record form

Administration

1. Score 1 for correct response and 0 for incorrect response.
2. Record time to complete response. Time limit is 3 minutes.
3. discontinue after 2 consecutive failures.

10. Planned Connections

Purpose-The student is presented with a page containing several boxes, in which are letters or numbers. The task is to connect the series of boxes containing letters or numbers in the correct sequence as quickly as possible. The task involves connecting, in the correct order, letters (A, B, C, . .), numbers (1, 2, 3, . . .), or numbers and letters (A, 1, B, 2, C, 3, . . .).

Focus-**planning**-organizing connections in the fastest manner possible.

Material

1. Response booklet
2. Pencil
3. Stopwatch

Administration

1. Ages 5-7, administer Sample A and Items 1-6. Ages 8 and above, administer Sample B, Items 7-8, Sample C, Items 9-10.
2. Start timing when sample is exposed, and stop timing when student reaches last number or letter in the series.
3. If an error is made, say: **Wait! You made a mistake. Begin again here.** Point to last correct response.
4. Record time for each item separately. Time limits are: Items 1-4, 1 minute, Items 5-7, 1.5 minutes, Items 8-10, 3 minutes. The student's score is the total time required to complete all items.

APPENDIX C - Miscue Scoring Criteria and Example of Miscue Analysis

Two basic questions are asked regarding miscues:

1. Do the words pronounced by the reader look like the words in the text? In other words, to what extent is the reader processing the graphic cues on the page?
2. Are the reader's miscues meaningful? In other words, does the reader use his knowledge to predict meaningful structures as he/she reads?

All substitution, mispronunciation, omission, and insertion errors are written on the coding sheet. Words which appear in the text are written in the column labelled text word. In the case of an omission, the word omitted is written here; with insertions, a caret is indicated. Miscues are recorded in the column labelled miscue, with omissions indicated by an O. Miscues are then coded according to the following three categories: corrections, graphic similarity, and meaningfulness.

1. Corrections. The extent to which the reader monitors his or her own reading is indicated by determining the percentage of miscues which are spontaneously corrected. Each miscue is marked for this category according to the following criteria.

   a. Yes. The reader attempts a correction and is successful.

   b. No. The reader either does not attempt a correction or is unsuccessful when such an attempt is made.

   If an error is corrected, the miscue is not coded in the categories of either graphic similarity or meaningfulness. However, it is useful for the examiner to look at the miscues which were corrected to get some indication of what type of miscue tended to be corrected. It is particularly

important to note whether the reader corrected miscues which were not meaningful since this is what good readers have been found to do (King, 1978; Beebe, 1980). If several non-meaningful errors are made and few of these are corrected, the reader needs to become aware of the importance of monitoring meaning as he/she reads. The percentage of errors corrected is calculated.

All those miscues which are not corrected are coded further in terms of the categories of graphic similarity and meaningfulness as outlined below.

2. Graphic Similarity. The extent to which the reader is able to process graphic cues is indicated by determining the degree of visual similarity between the word on the page and the reader's response. It is assumed that the letters which appear in both the stimulus word and the reader's response were likely processed by the reader from the print. It is further assumed that insertions and omissions were not triggered by graphic cues. Each miscue is judged as having high, partial, or no graphic similarity according to the following criteria.

a. High. Half or more of the letters in the text word are the same as those in the miscue (count the number of letters in the text word and determine how many of these appear in the miscue).

b. Partial. At least, one but fewer than half, of the letters in the text word are the same as those in the miscue.

c. None. No letters are the same in the miscue and text word. This also includes insertions and omissions.

The percentage of uncorrected miscues with high graphic similarity is calculated to determine the extent to which the reader relied heavily on graphic cues at points of uncertainty. It should be kept in mind that all of the words accurately identified also indicate effective processing of graphic cues.

3. Meaningfulness. In order to provide some indication regarding the extent to which the reader uses his/her knowledge of language and the world to predict words during reading, miscues are judged according to their meaningfulness. It is assumed that if miscues 'make sense' that the reader is attempting to use his/her knowledge base to aid in word identification as he/she reads aloud.

Each uncorrected miscue (including substitutions, mispronunciations, omissions, and insertions) is examined according to the following criteria.

a. High. The miscue results in the production of a meaningful sentence and is meaningful in relation to prior sentences in the passage as well.

b. Partial. The miscue results in a meaningful sentence but is not meaningful in relation to prior sentences in the passage OR the miscue is meaningful only in relation to the part of the sentence before or after it, but not both.

c. None. the miscue is not meaningful. This includes all nonsense words.

Sample Passage

The woman walked up and down. She walked all over the airplane. Then she asked (1. the) people to let her look into ~~their~~ (2. the) bags. People ~~helped~~ (3. help(e)) her look.

Then the woman came over to Harriet. ~~"It smells very bad here," she said.~~ (4.)

She looked at Harriet. "Do you have something that smells bad, little girl?" she asked.

"No," said Harriet. "That smell (5. instant) ~~isn't~~ from (6. her) ~~here~~. After all, (7. I(c)) ~~I~~ smelled the bad smell before the others did. It's not (8. her) ~~here~~."

The woman looked at the bag Harriet had. It was (9. a) ~~the~~ bag her Mom gave her.

"What (10. the) is in ~~this~~ bag, (11. the) little girl?" the woman asked. "(12. Look(e)) ~~Let~~ me look in your bag. I (13. wanted) ~~went~~ to see what is in it."

Miscue Coding Sheet

Name: Colin Date: June 18

Text Word	Miscue	Cor	Graphic Sim. H	Graphic Sim. P	Graphic Sim. L	Meaningfulness H	Meaningfulness P	Meaningfulness L
1. ^	the	No				X		
2. their	the	No	X				X	
3. helped	help	Yes						
4. It smells..	O	No					X	
5. isn't	instant	No	X					X
6. here	her	No	X					X
7. ?	it	Yes						
8. here	her	No	X					X
9. the	a	Yes						
10. this	the	No	X				X	
11. ^	the	No	X					X
12. let	look	Yes						
13. want	wanted	No	X				X	
14. ^	a	No				X		
15. the	at	Yes						
16. really	early	No	X					X
17. they	O	No						X
18. came	come	No	X					X
19. to look..	O	No						X
20. what	that	No	X					X

APPENDIX D - Scoring Criteria for PASS.

	Range				
Scale	Weak	B. Average	Average	A. Average	Strong
General Ability	< 4	5 - 6	7 - 9	10 - 11	12
Arithmetic	< 5	6 - 7	8 - 10	11	12
School Satisfaction	< 4	5 - 6	7 - 9	10 - 11	12
Reading/Spelling	< 5	6 - 7	8 - 10	11	12
Penmanship/ Neatness	< 4	5 - 6	7 - 9	10 - 11	12
Confidence	1	2	3 - 5	6 - 7	> 8
Full Scale	< 35	36 - 40	41 - 51	52 - 56	> 57

APPENDIX E - Description of CAP Training Tasks.

Window Sequencing (adapted from Bead Threading; Conway, 1975)

Purpose-The student's task is to reproduce a set of different colored and/or shaped chips by recall in the same order as modeled by the instructor. The series of chips is presented from left to right through a 2 x 2 window so that only one chip can be seen at a time (see Figure 19.). Each chip is presented for approximately one second. The student is then presented with the appropriate number, shape, and color of plastic chips with which to reproduce the sequence. There are three difficulty levels; the first level uses different shaped chips (round and square), and holds color constant,the second level uses different colored chips (white, yellow, blue, black) and holds shape constant, and the final level varies both color and shape of the chips. Each level has sequences of two to six chips (three sequences of each length).

Focus-successive-strategies include talking aloud, rehearsal, utilizing shape and color patterns

Materials-window chart, chip sequence strips, plastic chips, record form, stopwatch

Steps

1. The instructor gives directions to the student.

   a) the student will see a series of different shaped chips one at a time through the window.

   b) The student must watch the chips very carefully because when the presentation is finished, the student must reproduce the series in exactly the same order.

   c) It is suggested that the student verbalize the color of the chips as they are presented and as he/she reproduces the order, eg. "First the blue one, second the red one . . . .etc."

The instructor provides a sample for the student to practice the procedure. Any ambiguities in the task requirements are clarified. The student is asked to explain the task to ensure that he/she understands the procedure.

2. The instructor presents the first set of chips, then hands the appropriate number and shape of chips to the student.

3. The student reproduces the series of chips. The student's response is timed

4. Instructor provides feedback.

a). If the chips are in the correct order, instructor acknowledges and praises the correct response. He then asks the student how he/she performed the task, and if he/she used any special strategies. A score of 2 points is given for a correct response.

b). If mistakes are made, instructor presents the sequence again, reminding the student to verbalize the color and shape of each chip as he/she sees them and to rehearse the sequence. If the student reproduces the sequence correctly, he/she receives 1 point.

c) If the student still does not produce the proper sequence the instructor presents the entire stimulus strip to the student and allows him/her to match the sequence. O points are awarded. The instructor then reminds the student of the strategies of rehearsal of sequence and verbalizing the colors.

5. The procedure is repeated for 15 trials at the same difficulty level in each session. At each difficulty level the sequence lengths are gradually increased, starting at two chip sequences and moving to six chip sequences.

6. The instructor and student summarize the task and discuss strategies used. The parts of the task which the student found most difficult or simple are discussed, as well as ways in which the task could have been performed more easily by the student. The instructor then tells the student that they are now going to perform the same type of task, but this time there will be letters in the window, which will make a word.

Bridge to Window Sequencing

Purpose-The object of this task is to reproduce a set of letters in the same order as presented by the instructor, and then state the word which is spelled by the letters. The series of letters are are presented from left to right through a 2 x 2 window chart so that each letter is seen alone for approximately one second (see Figure 19.). Letters may be presented one at a time or in consonant or vowel combinations. There are three levels of difficulty which correspond to the difficulty levels of the words used.

Focus-successive-strategies include talking aloud, rehearsal, sounding, sound blending, predicting.

Materials-letter series, window chart, plastic letters, stopwatch

Steps

1. The instructor gives directions to the student.

    a) The student will see letters presented one at a time or in groups through the window.

    b) The student must watch the letters very carefully because they will spell a word, and when the presentation of the letters is finished, the student will reproduce the series with the plastic letters and say the word that they spell.

    c) It is suggested that the student sound out the letters as they are presented (eg. "C ....AAAAAAA.....T.")

The instructor provides a sample for the student to practice the procedure. Any ambiguities in the task requirements are clarified. The student is asked to explain the task to ensure that he/she understands the procedure.

2. The instructor presents the first set of letters, and then gives the appropriate letters to the student.

3. The student reproduces the series with the plastic letters and says the word. 2 points are awarded for a correct response. The student's response is timed.

4. The instructor provides feedback.

a) If a correct response is given the instructor acknowledges and praises the response. He then asks the student how he/she performed the task, and if he/she used any special strategies.

b). If the student does not correctly reproduce the letter order, the instructor presents the letter series again, reminding the student to verbalize and rehearse the sequence. The student is then allowed to reproduce the letters and state the word, and a 1 point score is awarded for a correct response. If the student correctly arranges the letters, but cannot state the word, the instructor informs the student that the sequence is correct, and to try again to sound out the letters and try to blend the sounds together to make the word. If the student correctly states the word a 1 point response is awarded.

c). If the student still cannot match the letters or state the word, the instructor demonstrates the correct response and helps the student to sound out the word. 0 points are then awarded. The instructor then reminds the student of strategies such as sounding out letters, rehearsal of series, and blending sounds.

5. The procedure is repeated for 15 trials in each session.

6. The instructor and student summarize the task and discuss strategies used. the parts of the task which the student found most difficult or simple are discussed, as well as ways in which the task could have been performed more easily by the student.

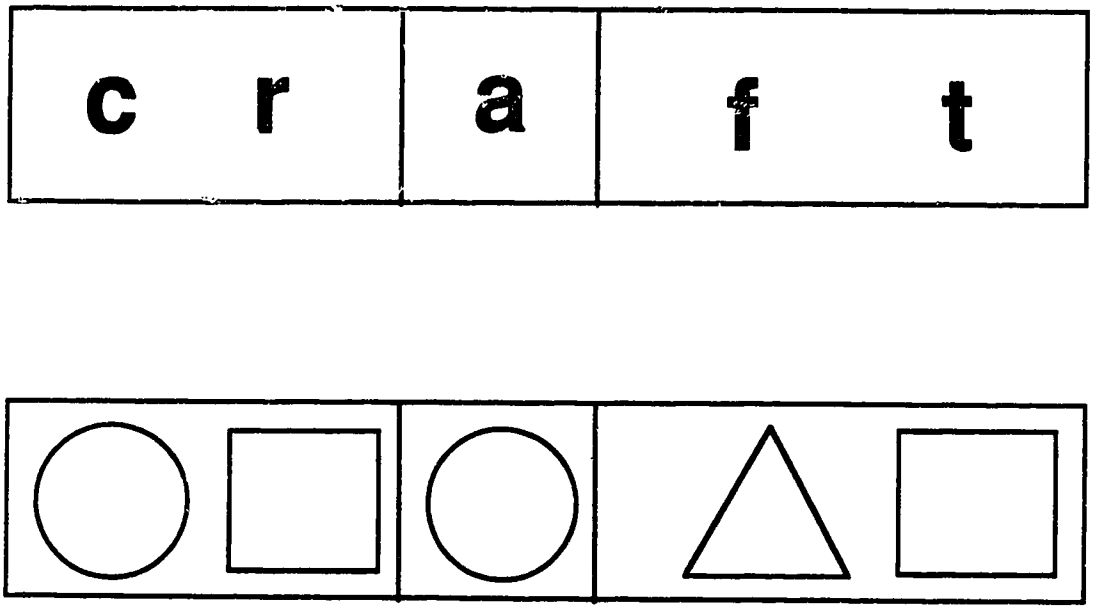

Figure 19. -Example of Window Sequencing Bridging and Global Tasks

Joining Shapes (adapted from Brailsford, 1981)

Purpose-The student's task is to join a series of geometric shapes with a pencil line in response to a series of verbal instructions, and following a set of rules. The shapes are triangles, squares, and hexagons. They are presented in rows, with a row of circles between each row of other shapes (see Figure 20. for example). There are three forms, corresponding to the number of rows of shapes. Form A consists of one row of triangles and one row of squares, with a row of circles between. Form B consists of one row of triangles, one row of squares, and one row of hexagons, with rows of circles between. Form C consists of a row of hexagons, a row of triangles, a row of squares, and another row of hexagons, with rows of circles between. There are also three levels of difficulty corresponding to the number of instruction given at any one time, which are one, two, or three instructions for Difficulty levels 1, 2 and 3 respectively.

Focus-successive-strategies include visual scanning, rehearsal of rules, talking aloud.

Materials-response sheets, instructions and answer key, record form

Steps

1. Instructor shows the student the example and gives directions:

    a) In this task the purpose is to learn to draw a pattern by joining triangles, squares, and hexagons. The student will be given instructions as to how to construct the pattern. There are four rules to remember when drawing the pattern:

        i) To join squares, triangles, and hexagons together, the student must always pass through a circle.

        ii) The line drawn must always go forward on the page (left to right) and never backward.

        iii) The line drawn must be continuous from the beginning to the end of the page, so the student should not lift his/her pencil during the task.

iv) The student must join the closest shapes which correspond to the instructions.

As the rules are provided, the instructor demonstrates their application on the sample item. The instructor then provides some instructions for the student to follow to ensure that he/she understands the task and the rules. Any ambiguities in the task requirements are clarified. The student is asked to repeat the instructions to ensure that the task is understood.

2. The instructor gives the student the response sheet and provides the directions for constructing the pattern. eg. "Join a triangle to a square, join a square to a triangle, join two triangles, join a triangle to a square."

3. The student follows the instructions and connects the shapes to produce the pattern. Each correct response to instructions is scored 2 points.

4. Instructor provides feedback.

a). If all responses are correct, instructor acknowledges and praises correct responding. He then asks the student how he/she performed the task, and if he/she used any special strategies.

b). If mistakes are made, instructor asks the student to stop and look carefully at his/her response, then repeats the instruction and allows the student to correct the response. A correct response here is awarded 1 point.

c). If the student still does not correctly respond, the instructor demonstrates the correct response, and the student is given 0 points. The instructor reminds the student of strategies such as scanning ahead before proceeding and rehearsing the rule. The task is then continued form the corrected response.

6. The procedure is followed for six items (two of each Form) to be followed using the same difficulty level.

7. The instructor and student summarize the task and discuss strategies used. The parts of the task which the student found most difficult or simple are discussed, as well as

ways in which the task could have been performed more easily by the student. The instructor then tells the student that they are now going to perform the same type of task, but this time they will join letters to make words.

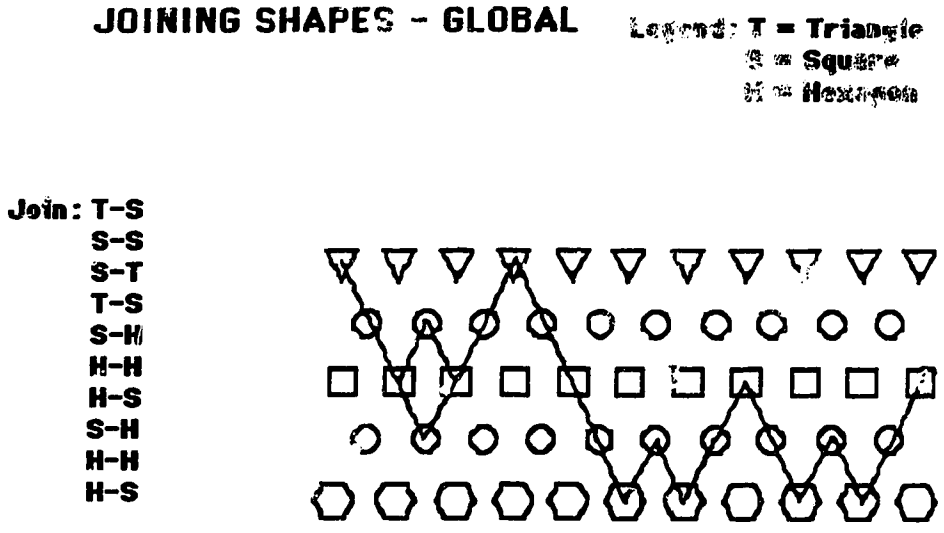

Figure 20. example of Joining Shapes global task.

Bridge to Joining Shapes

Purpose-The student's task is to join letters together to make words. Letters are presented to the student in several rows, and the task is to join the letters from the top row to the bottom row, moving from left to right in a diagonal manner, and form a word. When the student reaches the bottom he/she is to start with the last letter of the word they made, and proceed back up to the top to make another word (see Figure 21.). This series is continued until the student reaches the end of the sheet. The student is required to say the words aloud.

Focus-successive-strategies include visual scanning, rehearsal, sound blending, prediction.

Materials-stimulus sheets, scoring guide.

Steps

1. Instructor shows the student an example and gives directions:

    a) In this task the purpose is to learn to make words by joining letters. The student will be given instructions as to how to make the words. There are four rules to remember when drawing the pattern:

        i) The student must always start in the upper left hand corner of the page and proceed from the top to the bottom, or vice-versa, of the letter sheet to make a word.

        ii) All words on a sheet will be the same length, which corresponds to the number of lines on the page, and the student must make a connection to only one letter on each line to form each word.

        iii) The line drawn must always go forward across the page (left to right), and never backward (right to left).

        iv) The line drawn must be continuous from the beginning to the end of the page, so the last letter of each word is always the first letter of the next word.

v) The students must look for the closest letter which will make a word.

The instructor demonstrates the application of the rules on the sample item. The student then attempts to find other words on the sample page. The instructor provides feedback and clarifies any ambiguities in the task requirements. The student is asked to repeat the instructions to ensure that the task is understood.

2. The instructor provides the student with the first stimulus sheet and the student joins the letters according to the rules provided. The student then states the words spelled. Spontaneous corrections of wrong connections are permitted. 2 points are awarded for a correct response.

3. Instructor provides feedback.

a) If all connections for a word are correct, instructor acknowledges and praises the correct response. He then asks the student how they performed the task, and if they used any special strategies.

b). If incorrect connections are made, the instructor first asks the student to look carefully at the word that he/she has produced and say it. If the student states a word which is not spelled the instructor points out that the spelling is not correct. If the student gives a nonsense word the instructor asks the student what the word means, and points out that it is not a real word. In each case the instructor then asks the student to try again from the last correct connection, and reminds the student to sound out the letters and scan ahead before making a connection. If the student makes the correct connections but cannot state the word, the instructor informs the student that the connections are correct, and asks the student to start at the beginning of the word and try again to sound out the word . If the student makes the proper connections and says the word on the second trial, 1 point is awarded.

c). If the student still cannot make the connections, the instructor demonstrates the correct connections and/or helps the student to sound out the word. 0 points

are awarded here. The instructor then reminds the student of strategies such as scanning ahead before proceeding, sounding out letters, and sound blending.

6. The procedure is followed for each task in the session. For difficulty level one the session consists of three and four letter words. For level two four and five letter words are used. For level three, five and six letter words are used.

7. The instructor and student summarize the task and discuss strategies used. The parts of the task which the student found most difficult or simple are discussed, as well as ways in which the task could have been performed more easily by the student.

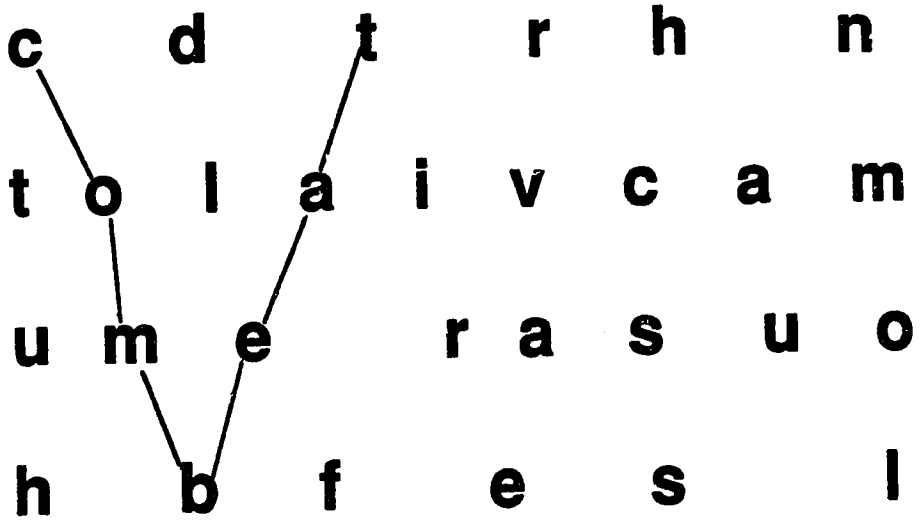

Figure 21. Example of Joining Shapes bridging task.

Serial Recall (Adapted from Kaufman, 1978)

Purpose - In this task the student is asked to memorize a set of pictures of objects in serial order. The pictures are line drawings drawn on 9 cm. x 9 cm. card (see Figure 22. for example). Pictures in each set represent two or three different categories (eg. fruit, tools, animals) which can be used to aid in memorization of the series. The levels of difficulty correspond to the number of pictures shown at one time, which are 4, 6, or 8 pictures for Difficulty levels 1, 2, and 3 respectively. The student's task is to recall, in order, each of the pictured objects in the series.

Focus - successive - visual scanning, verbalizing, rehearsal, categorization.

Materials - stimulus cards, record form, stopwatch

Steps

1. The student is shown a sample set of three cards and told that:

    a) the cards need to be studied carefully, and as each is placed before him/her, he/she should try to remember them by saying, "First. . .,second. . . , " etc., naming each picture.

    b) The cards will be removed and the student will have to recall each of the pictured objects in the correct order using his/her cards.

The students is allowed to practice on the sample item. Any ambiguities in the task requirements are clarified. The student is asked to repeat the directions to check his/her understanding of the task.

2. The student is presented the first set of cards. Each card from the first set is placed side-by-side in front of the student. If the student does not verbalize spontaneously, he is reminded to do so.

3. The cards are sequentially removed, starting with the first card placed in front of the student.

4. The student is given with a set of the same cards in a random order, and is asked to place the pictures in the order which they were presented using his/her own set of cards. The student's response is timed.

5. Instructor provides feedback.

a). If all cards are ordered correctly, the instructor acknowledges and praises the student's response. He then asks the student how he/she performed the task, and if he/she used any special strategies. The correct response is awarded 2 points.

b). If the student does not produce the proper sequence, the instructor removes the student's cards and repeats the presentation of the original series. The student is told that looking for similar categories among the pictures may help him/her to group the pictures and remember the sequence. If the student produces the correct response, he/she is awarded 1 point.

c). If the student still does not properly match the sequence, the instructor places and leaves the cards exposed on the table until the student matches the sequence with his/her cards. 0 point are awarded. The instructor then reminds the student of strategies such as verbalizing the pictures and rehearsing the order.

6 The procedure is repeated for six sets at the same difficulty level in each session.

7. The task is summarized by the student and instructor, discussing the strategies used for performing the task such as verbal rehearsal and visual scanning. The instructor then tells the student that he/she is now going to perform the same type of task, but this time he/she is going to recall a series of letters which make a word.

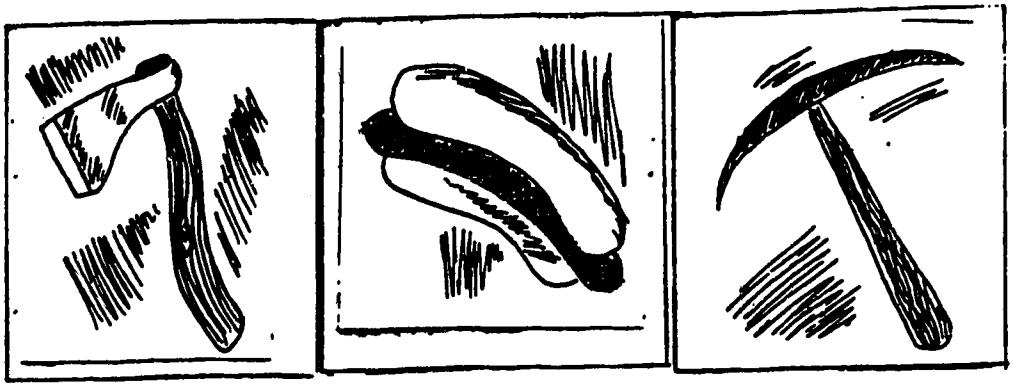

Figure 22. Example of Serial Recall global task.

Bridge to Serial Recall

Purpose - The student's task is to memorize a set of letters in serial order and state the word spelled by the letters. The plastic letters are presented one at a time until the entire word is spelled, and then removed in the same order. The words range from 3 to 7 letters in length.

Focus - successive - visual scanning, sequential short-term memory, sounding out, sound blending.

Materials - plastic letters, record form, stopwatch

Steps

1. The student is shown an example set of letters and told that:

    a) the letters should be studied carefully because together they make a word, and as each is placed before the student he/she should try to remember them by sounding them out.

    b) The letters would be removed and the student would need to recall each letter in the correct order and state the word spelled by the letters

The student is allowed to practice the task with the sample item, and any ambiguities in the task requirements are clarified. The student was then asked to repeat the directions to ensure that he/she understands the task.

2. The first word is presented. Each letter from the first word is placed side-by-side in front of the student. If the student does not verbalize spontaneously he/she is reminded to do so.

3. The letters are sequentially removed, starting with the first letter placed in front of the student.

4. The student is given the appropriate plastic letters and asked to reproduce the letters in the order which they were presented and state the word which they spell. The student's response is timed.

5. The instructor provides feedback.

a) If a correct response is provided, the instructor acknowledges and praises the response. The instructor then asks the student how they performed the task, and if they used any special strategies. 2 points are awarded for a correct response.

b). If the student does not provide the correct sequence of letters the instructor presents the sequence again, reminding the student to sound out the letters and rehearse the order.

c). If the student produces the correct sequence, but does not give the proper word, the instructor informs the student that he/she has the right sequence, but should try again to sound out the letters and blend the sounds together to say the word. If the student correctly responds after these prompts 1 point is awarded.

d). If the student still cannot reproduce the series or say the word the instructor presents the entire sequence and leaves the letters exposed for the student to match with his/her letters and state the word. 0 points are awarded here. The instructor then reminds the student of strategies such as visual scanning, rehearsal of order, and sound blending.

6. The procedure is repeated 5 times for each of the three letter lengths at a specific Difficulty level, resulting in a total of 15 trials in each session.

7. The instructor and student summarize the task and discuss strategies used. The parts of the task which the student found most difficult or simple are discussed, as well as ways in which the task could have been performed more easily by the student.

Transportation Matrices (adapted from Brailsford et al., 1984)

Purpose - The student's task is to reproduce a series of transportation pictures in the correct order. The pictures are exposed in cells on a horizontal line matrix. They are shown all at once, and then one at a time in their respective cells inside the matrix (see Figure 23. for example). The order of the pictures is always from left to right in order to be consistent with reading. There are three difficulty levels, containing four, five, and six picture sequences respectively.

Focus - successive - visual scanning, sequential rehearsal, verbalization, using cues in pictures (eg. color, shape) to aid memorization.

Materials - Fifty four transportation pictures (two sets), four, five, and six cell cardboard matrices, record form, answer key stopwatch

Steps

1. The student is told that:

a) he/she would be shown a set of pictures of different kinds of transportation on a matrix. He she will also be given a set of cards and a blank matrix.

b) he/she will be shown the pictures all at once, and then one at a time in their positions in the matrix. When he/she is shown the pictures one at a time, he/she will be asked to match the individual pictures with his/her transportation pictures in the appropriate cell of his/her matrix.

c) as he/she matches them he/she will be asked to verbalize, e.g., "First the bus, secondly the jet..." etc.

d) his/her cards will be removed and placed with a larger set of cards. The student will be required to re-select the appropriate cards and place them in proper sequence on his/her matrix.

The instructor provides a sample, and the student is allowed to practice the procedure. The instructor clarifies any ambiguities. The student is then asked to explain the directions to ensure that he has understood the task.

2. The student is given a blank cardboard matrix and a set of cards, which are left face-down on the table. He/she is then presented with the first set of pictures for approximately five seconds. The pictures are then presented individually from right to left through a window for approximately one second each. At this time he/she is allowed to pick up his/her set of pictures and match the order on his/her matrix.

3. The instructor's matrix is removed. The student's cards are then picked up and placed within a random assortment of ten cards. The pictures are returned to the student, and he/she re-selects the appropriate cards and re-constructs the picture series in the correct order on the blank matrix. The student's response is timed.

4. Instructor provides feedback.

    a). If correct, instructor acknowledges and praises the correct response. He then asks the student how they performed the task, and if they used any special strategies. 2 points are awarded.

    b). If mistakes are made in the selection or ordering of the pictures, instructor repeats the presentation of the sequence, reminding the student to verbalize the order and rehearse the sequence. Then student is then allowed to correct his/her response, and is awarded 1 point for a correct response.

    c). If the student still does not correctly produce the sequence, the instructor then leaves the entire sequence exposed to the student and allows him/her to match the pictures. 0 points are awarded. The instructor reminds the student of strategies such as verbalizing the order and rehearsal.

5. The procedure is repeated for five trials at each difficulty level.

6. The instructor and student summarize the task and discuss strategies used. The parts of the task which the student found most difficult or simple are discussed, as well as ways in which the task could have been performed more easily by the student. The instructor then tells the student that he/she is now going to perform the same type of task, but this time they will memorize series of letters which will make words.

The material used in this figure was removed because of the unavailablity of copyright permission. The figure contained pictures of various forms of transportation from the commercial game Traffic Lotto (F. X. Scmid, 19__).

Figure 23. Example of Transportation Matrices global task.

Bridge to Transportation Matrices

Purpose - The student's task is to reproduce a series of letters in the correct order and state the word which is formed by the letters. The letters are exposed together on a horizontal line matrix, and then one at a time in their respective positions in the matrix (see Figure 24. for example). The order of the letters is always from left to right in order to be consistent with reading. The letters are presented in a flip-chart format.

Focus - successive - visual scanning, sequential rehearsal, sounding out letters, sound blending.

Materials - plastic letters, matrix flip charts, record form, three to seven cell cardboard matrices, stopwatch.

Steps

1. The student is told that:

    a) he/she will be shown a matrix with some letters on it, and together the letters will make a word.

    b) the letters will be shown together and then one at a time in their positions on the matrix.

    c) as he/she sees the letters he/she should pay careful attention to them, because after they are taken away he/she will have to reproduce the sequence of letters with plastic letters and state the word that they spell.

    d) after the sequence is presented he/she will be given a blank cardboard matrix and be asked to select plastic letters from a larger group of letters and place them in the proper sequence on the matrix. He/she will then state the word which was spelled by the letters.

The instructor provides a sample item and the student is allowed to practice the procedure. The instructor clarifies any ambiguities. The student is then asked to explain the directions to ensure that he/she understands the task. The instructor then models a task demonstration of the procedures.

2. The student is shown the first set of letters all together for approximately five seconds, and then individually in their positions in the matrix for approximately one second.

3. The student is provided with a blank matrix and plastic letters. He/she then selects and re-constructs the letter series in the correct order on the blank matrix, and states the word spelled. The student's response is timed.

4. The instructor provides feedback.

a) If a correct response is given the instructor acknowledges and praises the response. The instructor then asks the if he/she used any special strategies to complete the task. 2 points are awarded for a correct response.

b) If the correct sequence is not reproduced the instructor removes the plastic letters and presents the series of letters again, reminding the student to sound out the letters and rehearse the sequence. The student is then given a second opportunity to reproduce the sequence. If the correct sequence is given, but the student cannot say the correct word, the instructor informs the student that the sequence is correct, but to try again to sound out the letters and blend the sounds together to say the word. 1 point is awarded for a correct response at this point. If the student still cannot reproduce the series or say the word the instructor presents the entire matrix and the student is allowed to match the letters. The instructor then helps the student to sound out the word as necessary. 0 points are awarded. The instructor then reminds the student of strategies such as visual scanning, rehearsal of order, and sound blending.

6. The procedure is repeated 5 times for each of the three letter lengths at a specific difficulty, for a total of 15 trials in each session.

7. The instructor and student summarize the task and discuss strategies used. The parts of the task which the student found most difficult or simple are discussed, as well as ways in which the task could have been performed more easily by the student.

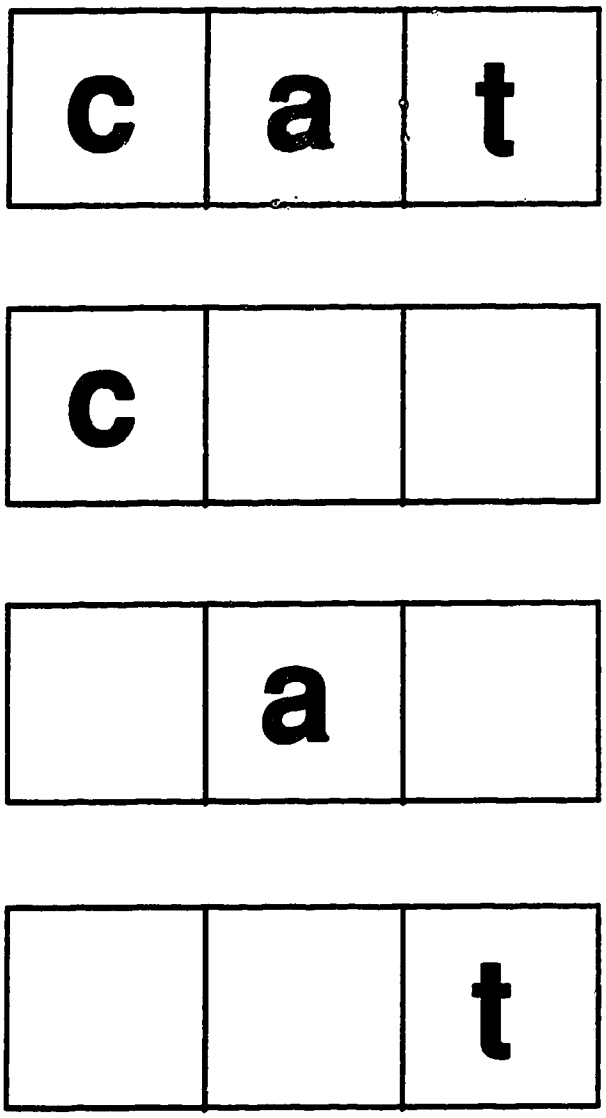

Figure 24. Example of Transportation Matrices Bridging task.

Connecting Letters (adapted from Krywaniuk, 1974)

Purpose-The student's task is to find which letters on the left side of a page is connected to which letter on the right side of the page by following a line which crosses the page (see Figure 25. for example). There are five pairs of letters in each stimulus page, and three pages are presented per session. There are three levels of difficulty. The first level contains colored strings which the student can follow with his/her finger in order to determine the connection, the second level has black lines, but the student is still allowed to follow with his/her finger, the third level contains black lines and the student must not use his/her finger, but simply follow the lines with his/her eyes.

Focus-successive-strategies include visual scanning, using finger to follow line, rehearsal.

Materials-stimuli sheets, record form, stopwatch.

Steps

1. Instructor presents a sample page and tells the student that:

a) the letters on the left-hand side of the page are connected to the letters on the right-hand side of the page by the lines which cross the page.

b) he/she will be required to find out which letters on the left were connected to which letters on the right by following the lines across the page. On Difficulty levels one and two the student can use fingers, on Difficulty level three he/she must only use eyes.

The student practices the procedure on the sample. The instructor clarifies any ambiguities. The student is then asked to repeat the directions to ensure that he understands the task.

2. The instructor provides the first stimulus page. The student attempts each letter pair on the page, and the instructor provides feedback after each page is completed. The time required to complete the page is recorded.

a). If all matches are correct, instructor acknowledges and praises the correct response. He then asks the student how he/she performed the task, and if any special strategies were used. 2 points are awarded for each correct response.

b). If incorrect matches are made, the instructor informs the student which ones are incorrect, and asks the student to try again, reminding him/her to try to look ahead with his/her eyes to see where the string is going, and verbalize the letters. If on trial three, where following only with the eyes is required, the student is allowed to follow with a finger. If the correct response is given on the second trial, 1 point is awarded.

c).If the student still does not correctly match the letters, the instructor demonstrates the appropriate route to the student, and a 0 point response is given. The instructor then reminds the student of strategies such as scanning ahead before proceeding.

3. The procedure is repeated for fifteen trials (5 per sheet) at the same difficulty level.

4. The instructor and student summarize the task and discuss strategies used. The parts of the task which the student found most difficult or simple are discussed, as well as ways in which the task could have been performed more easily by the student. The instructor then tells the student that they are now going to perform the same type of task, but this time there will be letters along the strings which will make words.

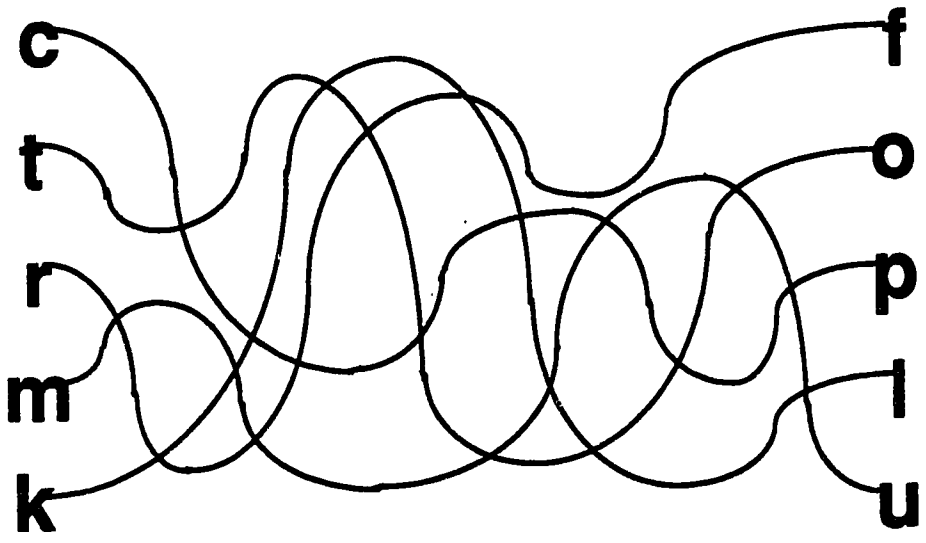

Figure 25. Example of Connecting Letters global task.

Bridge to Connecting Letters

Purpose-The student is presented with a sheet containing five single letters, or consonant digraphs, on the left side of the page, and five single letters, or consonant digraphs, on the right side of the page. These letters are connected with lines which run across the page. Along these lines there are also letters, presented singly or in consonant or vowel blends. Each string of letters forms a word (see Figure 26. for example). The task is to follow, with eyes only, the line connecting the series of letters across the page and state the word which is spelled by the letters.

Focus-successive-strategies include visual scanning, rehearsal, sound blending.

Materials-stimuli sheets, stopwatch

Steps

1. Instructor presents the sample item and tells the student that:

    a) the lines going across the page have letters on them, and all together the letters on each line make a word.

    b) he/she is required to follow each line with his/her eyes only, and state the word that is made by the letters.

    c) He/she should try to sound out the letters and look along the lines to see how the letters go together to make a word

The student practices the procedure on the sample item, and any ambiguities in the task requirements are clarified. The student is then asked to repeat the directions to ensure that he/she understands the task

2. The instructor presents the first stimulus page, and the student attempts each word on the page by following the line and stating the word. The time required to complete the page is recorded.

3. The instructor provides feedback.

a) If a correct response is given the instructor acknowledges and praises the response. The instructor then asks the student how they performed the task, and if they used any special strategies. 2 points are awarded for a correct response.

b). If the student follows the line correctly, but states the wrong word, the instructor informs the student that he/she got the sequence correct, and asks the student to try again to sound out the letters and blend them together to say the word. If the student cannot follow the string the instructor asks him/her to try again to find the sequence, using his/her fingers if necessary, and reminds the student to sound out the letters and rehearse the sequence. If the student still cannot reproduce the word the instructor allows the student to write down each letter as he/she comes to it on the line, and then state the word. 0 points are awarded here. The instructor then reminds the student of strategies such as visual scanning, rehearsal, and sound blending.

7. The instructor and student summarize the task and discuss strategies used. The parts of the task which the student found most difficult or simple are discussed, as well as ways in which the task could have been performed more easily by the student.

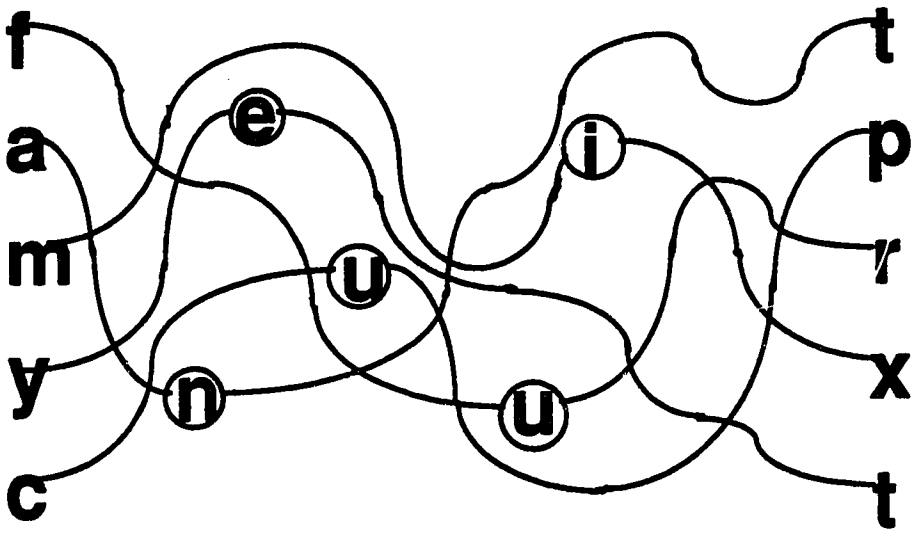

Figure 26. Example of Connecting Letters bridging task.

Related Memory Set-Part One (adapted from Brailsford, 1981)

Purpose-The student's task is to match the front halves to the back halves of animals. The fronts and corresponding backs for three animals are presented in two vertical columns (see Figure 27. for example), and the student must point to the fronts which go with the backs. The student then alters or confirms this selection by placing the fronts and back halves together. There are three difficulty levels corresponding to the similarity of the three animals in each set.

Focus.- successive - visual scanning, left to right synthesis, using visual cues (eg. color, shape) to aid in matching.

Materials.- stimulus cards, record form, stopwatch

Steps.

1. The student is presented with a sample set of pictures and told that:

    a) the pictures arranged on the table are the fronts and backs of animals.

    b) the task is to predict which front half of the animal goes with which back half of the animal by pointing to them.

The student is allowed to attempt the sample, and ambiguities in the procedure are clarified. The student is then asked to repeat the directions to ensure that he/she understands the task.

2. The first set of backs and fronts of three animals are presented to the student.

3. The student makes his/her selections of the animals by pointing at the matching halves. The time required to make all three selections is recorded. The instructor then asks the student to explain his/her reasons for the prediction.

4. The student physically matches the front halves to the back halves and is asked by the instructor the reasons for making these selections.

a). If all matches are correct, instructor acknowledges and praises the correct response. He/she then asks the student how he/she performed the task, and if any special strategies were used. 2 points are awarded.

b). If any responses are incorrect, the instructor asks the students if they are satisfied with their responses, and the student is allowed to spontaneously correct any responses.

c). If responses are still incorrect shows the student pictures of the entire animals and allows him/her to make corrections.

5. The student attempts each picture in the session, which consists of six sets of three animals at the same level of difficulty.

6. The instructor and student summarize the task and discuss strategies used. The parts of the task which the student found most difficult or simple are discussed, as well as ways in which the task could have been performed more easily by the student. The instructor then tells the student that he/she is now going to perform the same type of task, but this time the fronts and backs of words will be matched.

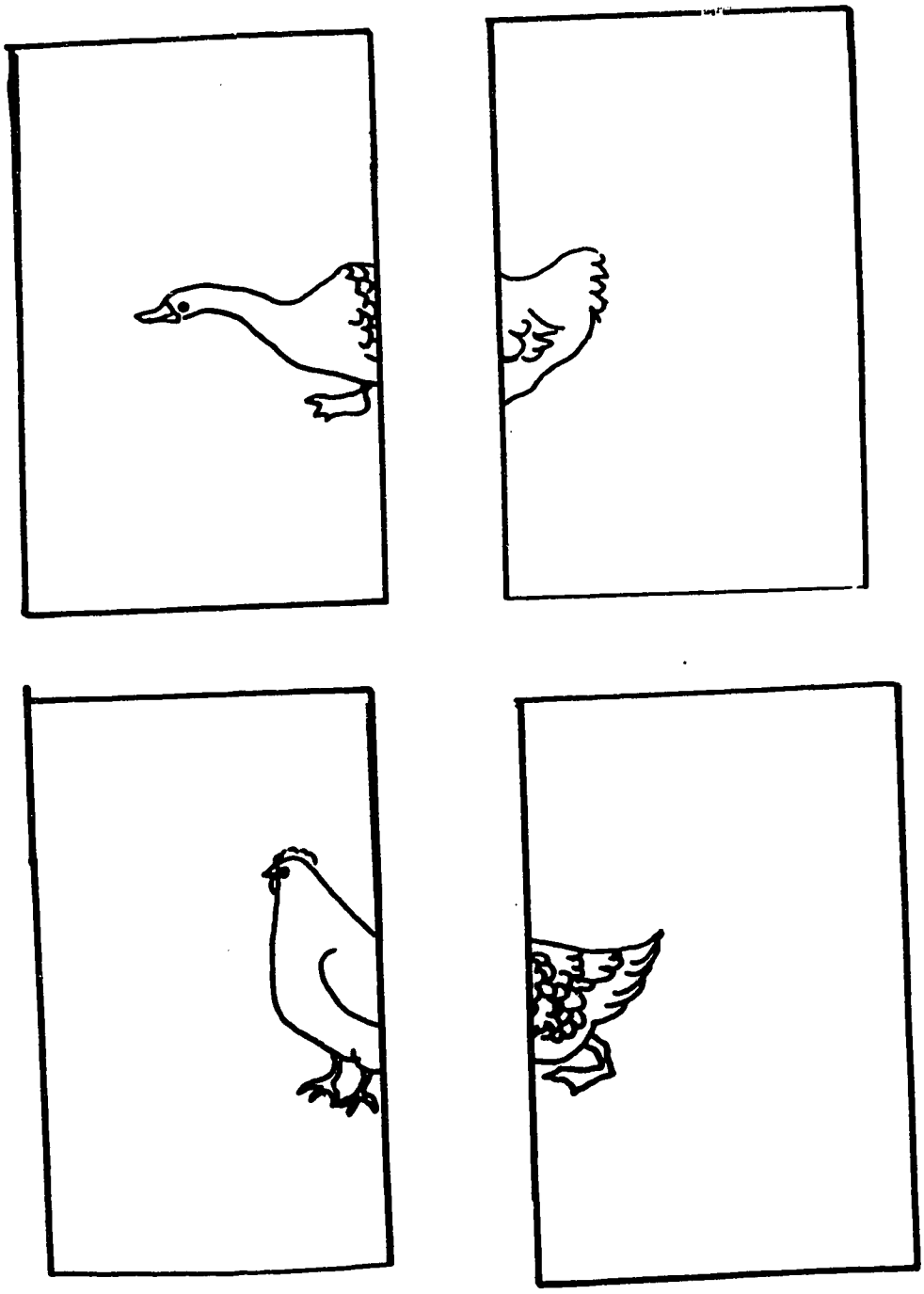

Figure 27. Example of Related Memory Set global task.

Bridge to Related Memory Set

Purpose-The student's task is to choose the proper front half of a word to match the back half and state the word. Three alternative word fronts are placed on the left of a page and one word back is placed on the right (see Figure 28. for example). The student must draw a line from the back of the word to the appropriate front and state the word.

Focus.- successive - visual scanning, left to right synthesis, sound blending.

Materials - stimuli sheets, pencil and eraser, record form, stopwatch

Steps.

1. The student is provided a sample item and told that:

    a) the letters arranged on the sheet are the fronts and the backs of words.

    b) the task is to determine which front half goes with the back half of the word, draw a line from the front to the back, and say what the word is.

The instructor demonstrates with the first word, and the student is allowed to practice on the other sample words. Any ambiguities are clarified. The student is asked to repeat the directions to ensure that he/she understands the task.

2. The student is presented with the first sheet, containing five items, and is asked to draw a line on the paper from the appropriate front half to the back half of each word on the page and say the word. The time required to complete all items on the page is recorded.

4. The instructor provides feedback:

    a) If all responses are correct, the instructor acknowledges and praises the response. The instructor then asks the student how they performed the task, and if they used any special strategies. 2 points are awarded for a correct response.

    b). If incorrect responses are made, the instructor informs the student of which responses are incorrect. If the student does not match the word halves correctly, the instructor asks what the word is. If the student gives a different word, the

instructor informs the student that the spelling of that word is different. If the student gives a nonsense word, the instructor says that that is not a real word. In both cases, the instructor asks the student to try again, to match the front and back halves of the word. If the student correctly matches the front and back, but does not state the word correctly, the instructor informs him/her that the match is correct, and asks him/her to try again to sound out the letters and blend the two parts together to make one word. 1 point is awarded for a correct response after these prompts.

c). If the student still cannot match the front and back and say the word, the instructor allows the student to write down the connections on a blank sheet of paper so that he/she can visualize the connection, and reminds the student to sound out the word. The instructor then reminds the student of strategies such as scanning ahead before proceeding or looking for visual cues to determine which front went with which back.

5. The instructor and student summarize the task and discuss strategies used. The parts of the task which the student found most difficult or simple are discussed, as well as ways in which the task could have been performed more easily by the student.

Figure 28. Example of Related Memory Set bridging task.