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SHORT-TERM MEMORY ABILITIES OF LEARNING
" DISABLED AND LANGUAGE IMPAIRED
CHILDREN

A Thesis
by
BETSY BARBER SHOAF

Submitted to the Graduate School
Appalachian State University
in partial fulfillment of the requirements for the degree of
MASTER OF ARTS

August 1983

Major Department: Speech Pathology
and Audiology

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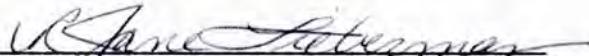
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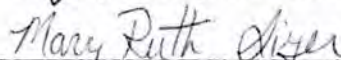
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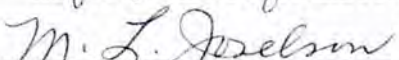
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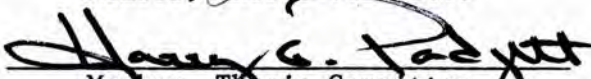
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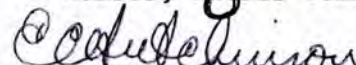
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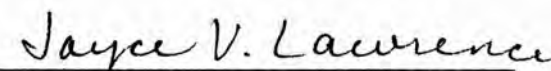

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ABSTRACT

SHORT-TERM MEMORY ABILITIES OF LEARNING DISABLED AND
LANGUAGE IMPAIRED CHILDREN (August 1983)

Betsy Barber Shoaf, B.S., Appalachian State University

M.A., Appalachian State University

Thesis Chairperson: Dr. R. Jane Lieberman

The purposes of this study were: (a) to compare the short-term memory abilities of learning disabled and language impaired children with respect to digit sequencing (DS), unrelated words (UW), related syllables (RS), oral directions (OD), details in spoken paragraphs (DSP), and phonemic synthesis (PS); and (b) to examine the relationship between performance on these six tasks for the two individual groups.

The subjects consisted of 28 children from the first, second, third, and fourth grades who were placed into two groups: a group of 14 learning disabled and a group of 14 language impaired children. All children were receiving resource services for either learning disability or language impairment and demonstrated adequate hearing and normal intelligence (IQ = 85 or above) as measured by the Slosson Intelligence Test. All language impaired children achieved a language quotient of 85 or below on the Test of Language Development. Subjects were matched according to age (\pm six months), IQ (\pm 10 points), and reading achievement (\pm six

percentile points). The six tasks of the short-term memory battery were individually administered in a random order to all children within a three week period.

Results of six two tailed t tests revealed that the learning disabled scored significantly better on the DS, the UW, the RS, and the PS. No significant differences were found on the OD or the DSP. Significant Pearson product moment correlations found among the tasks for the learning disabled group included: the Simple and Weighted scores of the UW, the UW, the DS, the UW and RS, and the OD and RS. Significant correlations found among the tasks for the language impaired group included: the Simple and Weighted scores of the UW; the UW and RS; the UW and the DSP; the UW and the OD; and the RS and the OD.

The results of this study indicated that the short-term memory abilities of learning disabled children exceeded those of language impaired children. However, as a group, 58 percent of the learning disabled children scored below age level on the entire short-term memory battery as compared to 74 percent of the language impaired. Therefore, although the learning disabled scored higher on various tasks, short-term memory deficits were present within this group as well as within the language impaired group. Speech and language pathologists and teachers of learning disabled students should assess memory abilities during every diagnostic procedure in order to better manage children in whom deficits may be apparent.

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Chapter 1

INTRODUCTION

Throughout the first few years of life, the auditory modality plays a vital role in children's development by exposing them to experiences which lay the foundation for all future learning. During the school years, audition continues to be singled out as an important faculty in providing the language background upon which academic information can be superimposed (Aten, 1974). The various operations encompassed by the auditory modality are basic to virtually all learning (Myklebust, 1971a).

For most individuals, the auditory processing system functions smoothly from birth to old age. Some children, however, demonstrate a malfunction at one level or another of this system (Sanders, 1977). Fisher (1982) reported an increasing awareness of the existence of auditory processing problems in children and commented on their significance in language and learning. Educators are increasingly aware that, although auditory processing skills are generally acquired in early childhood without specific training, not all children enter school with adequate competency in this modality of learning (Wiig & Semel, 1980).

The term auditory processing includes many aspects. Aram and Nation (1982), described five auditory operations involved in auditory processing, including: (a) auditory attention: the

ability to attend selectively to certain auditory stimuli and ignore irrelevant stimuli; (b) auditory rate: the ability to process auditory information at various rates of input; (c) auditory discrimination: the ability to differentiate between sound patterns; (d) auditory sequencing: the ability to hold information in specific order; and (e) auditory memory: the ability to remember auditory stimuli. Interference with any of these operations is likely to result in an inability to interpret an auditory pattern. By assessing children's skills in these individual aspects of auditory processing, researchers and educators obtain a clearer understanding of difficulties children encounter in understanding spoken language (Sanders, 1977).

The ability to remember is a vital part of processing information (Ring, 1975), and its disruption constitutes one of the major problems in the area of auditory processing (Fisher, 1982). In this investigation, the operation of auditory memory, more specifically short-term memory, is extracted from the total auditory processing model for study because memory is thought to be crucial for learning and language development by numerous educators (Bangs, 1968; Barr, 1972; Heasley, 1980; Wiig & Semel, 1980). Sanders (1977) noted that it is essential for the auditory system to hold sections of spoken patterns in storage. This storage involves two components, short-term and long-term memory.

The overall memory system was described by Atkinson and Shriffrin (1971) in terms of the flow of information into and out of short-term storage. According to these authors, "short-term

storage is considered a working memory: a system in which decisions are made, problems are solved and information flow is directed" (p. 83). Adams (1967) defined short-term store as "the memory store that is tested by recall of a small amount of material within a brief period of time" (p. 37). Short-term memory deficiencies may impede the learning process since it is through the short-term process that long-term storage, the more permanent memory, is reached (Parker, Freston, & Drew, 1975).

Because short-term memory plays such an important role in overall learning, it is easy to understand how children with deficits in this operation would have problems in the acquisition of language skills and other academic information. Teachers have felt for some time that children with learning disorders exhibited inadequate memory skills (Meire, 1976), and speech-language clinicians have identified reduced memory function as a possible etiological factor in deficit speech and language (Powers, 1971).

Various studies have compared the memory of learning disabled children to "normal" children (Cohen & Netley, 1981; McGrady & Olson, 1970; Peterson & Peterson, 1959; Torgesen & Houck, 1980), and to a lesser degree, investigators have compared these same skills in language impaired and "normal" children (Albert, 1976; Menyuk & Looney, 1972); but there appears to be little research comparing the memory abilities of learning disabled to language impaired children. The need for this research is apparent since memory serves as a link between the language children hear and read and the language they speak and write (Wiig & Semel, 1980). A

comparison of short-term memory in the learning disabled and language impaired populations is necessary for purposes of differential diagnosis of speech and language problems and learning disabilities, as well as therapeutic and academic intervention for both groups. As Myklebust (1971a) stated, "perception is the first stage in the process requisite for language learning: That which is perceived must be remembered" (p. 1192).

Statement of Problem

The purpose of this study was twofold: (a) to compare the short-term memory abilities of children identified as learning disabled and language impaired, with respect to digit sequencing, unrelated words, related syllables, oral directions, details in spoken paragraphs, and phonemic synthesis; and (b) to determine relationships between performances on these short-term memory tasks for the individual groups of learning disabled and language impaired children.

More specifically, answers to the following questions were sought:

1. Is there a significant difference in the short-term memory abilities for the tasks of digit sequencing, unrelated words, related syllables, oral directions, details in spoken paragraphs, and phonemic synthesis between the groups of learning disabled and language impaired children?

2. Is there a significant correlation between performances on the short-term memory tasks of digit sequencing, unrelated words, related syllables, oral directions, details in spoken

paragraphs, and phonemic synthesis for the individual groups of learning disabled and language impaired?

This study was part of a larger study which compared the language abilities (Moore, 1983) and reading abilities (Scarboro, 1983) of learning disabled and language impaired children.

Hypotheses

In order to give direction to the data analysis, hypotheses were developed in the null form and tested at the .05 level of significance.

Major Null Hypothesis 1

There is no significant difference in various aspects of auditory short-term memory ability between learning disabled and language impaired children.

Null subhypothesis 1.1. There is no significant difference in the auditory short-term memory ability for digit sequencing between learning disabled and language impaired children.

Null subhypothesis 1.2. There is no significant difference in the auditory short-term memory ability for unrelated words between learning disabled and language impaired children.

Null subhypothesis 1.3. There is no significant difference in the auditory short-term memory ability for related syllables between learning disabled and language impaired children.

Null subhypothesis 1.4. There is no significant difference in the auditory short-term memory ability for oral directions between the learning disabled and language impaired children.

Null subhypothesis 1.5. There is no significant difference in the auditory short-term memory ability for details in spoken paragraphs between learning disabled and language impaired children.

Null subhypothesis 1.6. There is no significant difference in the auditory short-term memory ability for phonemic synthesis between learning disabled and language impaired children.

Major Null Hypothesis 2.

There is no significant correlation among performances on the short-term memory tasks of digit sequencing, unrelated words, related syllables, oral directions, details in spoken paragraphs, and phonemic synthesis for the individual groups of learning disabled children and language impaired children.

Null subhypothesis 2.1. There is no significant correlation among performances on the short-term memory tasks of digit sequencing, unrelated words, related syllables, oral directions, details in spoken paragraphs, and phonemic synthesis for the learning disabled group.

Null subhypothesis 2.2. There is no significant correlation among performances on the short-term memory tasks of digit sequencing, unrelated words, related syllables, oral directions, details in spoken paragraphs, and phonemic synthesis for the language impaired group.

Delimitations

The following were delimitations of the study:

1. The study was confined to two groups: a learning disabled and language impaired group with 14 children per group.

2. Children were selected from the first, second, third, and fourth grade populations of the Davidson County School System in North Carolina. All children were receiving services for either learning disability or language impairment at the time of the study. Inclusion in the study was based on the following criteria:

a. All children demonstrated normal intellectual function (IQ of 85 or above) on the Slosson Intelligence Test for Children and Adults (Slosson, 1978).

b. Children in the learning disabled group met requirements for placement in the Learning Disability Program as established by the Davidson County School System (see Appendix A). Children in the language impaired group achieved a language quotient of 85 or below on the Test of Language Development (Newcomer & Hammill, 1977).

c. Children were native speakers of English from monolingual homes who did not exhibit any gross peripheral defects of audition or vision.

3. The auditory short-term memory battery was confined to the following six tests: (a) Auditory Sequential Memory Subtest of the Illinois Test of Psycholinguistic Abilities (Kirk, McCarthy, & Kirk, 1968); (b) Auditory Attention Span for Unrelated Words of the Detroit Tests of Learning Aptitude (Baker & Leland, 1967); (c)

Auditory Attention Span for Related Syllables of the Detroit Tests of Learning Aptitude (Baker & Leland, 1967); (d) The Token Test for Children (DiSimoni, 1978); (e) Processing Spoken Paragraphs Subtest of the Clinical Evaluation of Language Functions (Semel & Wiig, 1980); and (f) The Phonemic Synthesis Test (Katz & Harmon, 1981a).

Limitations

The following were limitations of the study:

1. To the extent that participants were not representative of the learning disabled or language impaired population at large, results will not be generalizable to samples beyond this study.
2. To the extent that language therapy or resource help on auditory memory skills may have influenced the outcome on the various tasks in the study, results may be biased in favor of one group or another.
3. To the extent that participants were aware of their participation in a research study, results might not be generalizable to other populations beyond this study.
4. To the extent that the speech and language clinicians who administered the auditory memory battery were more familiar with the language impaired children, results might be biased in favor of this group.

Assumptions

The following assumptions were made in the present study:

1. That the groups of learning disabled and language impaired children were matched on relevant variables: age, IQ as measured by the Slosson Intelligence Test for Children and Adults

(Slosson, 1978), and reading achievement, as measured by the Prescriptive Reading Inventory (CTB/McGraw-Hill, 1976), and the California Achievement Test (CTB/McGraw-Hill, 1978); and any extraneous variables were randomly distributed between the groups.

2. That all speech and language clinicians who aided in the research through administration of the various auditory memory tests to children within their respective schools specifically followed the standardized procedures presented by the researcher.

3. That the researcher, being a practicing speech and language clinician, was qualified to administer, score, and interpret all testing procedures used in this study.

4. That tasks utilized to assess auditory short-term memory abilities, in fact, measured these abilities.

Chapter 2

REVIEW OF RELATED LITERATURE

The review of related literature contains information pertaining to studies and reports concerning auditory processing and short-term memory.

The Scope of Auditory Processing

Auditory processing includes all of the abilities and skills involved in processing information received aurally (Fisher, 1982). From birth until death, humans are involved in a continuous process of learning, the majority of which is accomplished through the auditory and visual senses. During the first few years of life, nearly all language is processed and learned through the auditory channel. As children continue to mature and as the meanings of words become more complex, the auditory pathway becomes even more significant in the language learning process (Fisher, 1982). In 1967, Johnson and Myklebust noted that little consideration had been given to deficiencies of the auditory process when compared with impairments of visual perception. However, in recent years, there has been an increasing awareness of the existence and importance of auditory processing problems (Fisher, 1982).

Traditionally, the auditory system has been evaluated through valid and reliable audiological tests of hearing acuity. It is now recognized that these standard tests of the peripheral auditory

mechanism may fail to detect the more subtle deficiencies of auditory processing (Willeford & Billger, 1978). A child may have intact peripheral sensitivity, but be limited in the understanding of what is heard, from a slight degree to almost total noncomprehension (Stubblefield & Young, 1975). Understandably, the scope of auditory processing has been extended in recent years from a study of the peripheral auditory mechanism to include the central processing of speech stimuli and the understanding of language (Lemme & Daves, 1982).

The central auditory area of the brain is the auditory cortex located in the temporal lobes. Damage in the central area can manifest itself in impaired reception or interpretation of the message. Therefore problems of auditory discrimination, comprehension and memory, for example, could be present without equivalent involvements of visual psychoneurological processes. However, in order for processing to occur in the central auditory area of the brain, the acoustical signals which make up the individual language system being acquired must be received through an intact peripheral system (Wood, 1975).

Disturbances in global aspects of auditory processing arise from cerebral lesions or improper connections between the auditory area of the brain and some other sensory, motor or integrating area of the brain (Gerber & Mencher, 1980). Disorders may also arise from a pathology in those structures which connect the two hemispheres of the brain. This is supported by Fisher (1982) who perceives an auditory processing deficit as a dysfunction or a

disruption of the ability to perceive and process auditory signals within the central nervous system. Primary prenatal and natal factors associated with these central auditory deficits range from tumors to debilitating disease processes to birth trauma. The end result of these disruptions is that the delicately balanced relationships between cognition and language, and between language and academic behavior are disturbed (Gerber & Mencher, 1980).

The ability to listen, speak, read and write is accomplished with ease for the majority of young children, but, there are still an alarming number who fail to attain these necessary skills (Wood, 1975). In recent years, there has been a growing concern for this group of children who, despite normal sensory functions and normal intelligence, experience considerable difficulty in learning situations (Sanders, 1977). Among the problems these children exhibit are those associated with auditory learning tasks. Often, these children with auditory processing problems are part of an undiagnosed or mislabeled group with communication disorders, who may experience learning and behavioral problems in school (Culbertson, 1981). The auditory processing dysfunctions in these children are responsible for a large portion of their learning disabilities (Wood, 1975), and these dysfunctions are also thought to underlie their disordered language behavior (Aram & Nation, 1982; Aten, 1974).

Auditory processing involves a variety of functions which interact and re-interact at various perceptual and cognitive levels (Wood, 1975). The effect of a dysfunction at an early age

interferes with normal speech and language acquisition, however, symptoms may fail to appear until the more sophisticated aspects of processing are required by the learning of a special skill such as reading (Sanders, 1977). Although the prevalence of auditory processing disorders in children has yet to be ascertained, Fisher (1982) speculated that approximately five percent of the elementary student population has significant difficulty with one or more aspects of auditory processing.

A Model of Auditory Processing

Aram and Nation (1982) recognized five operations of auditory processing: (a) auditory attention; (b) auditory rate; (c) auditory discrimination; (d) auditory sequencing; and (e) auditory memory. These operations are not mutually exclusive nor are they necessarily considered to be hierarchical stages of perceptual processing. They function simultaneously, in an interrelated, complex, continuous manner (Aram & Nation, 1982). The authors justified the selection of these five operations on a pragmatic basis since the disruption of each operation may be reflected in clinically observable perceptual problems.

Auditory Attention

Attention incorporates such concepts as selective attention, the ability to ignore irrelevant auditory stimuli and to separate auditory figure ground relationships (Aram & Nation, 1982). Specifically, it has been defined as "the ability to focus appropriately on the object or task at hand" (Bangs, 1968, p. 35). The

importance of attention was emphasized by Sanders (1977) who noted that listening could not take place in its absence.

According to Sanders (1977), attention is a developmental phenomenon which involves the filtering out of redundant information. Sensory overload occurs when the filtering function of the sensory system does not operate effectively. One possible cause of this disruption in attention may be a disordered mechanism which does not allow children to make rapid shifts (Bangs, 1968, 1982). Unable to move along to another task, the children appear "fixed" (Bangs, 1968, 1982) and attend too much to the task or intrusion at hand. According to Bangs (1982), other attentional disruptions result from one or more of the following:

1. Failure to attend to the significant features of the task at hand, resulting in lack of comprehension of the objective of the task.
2. Failure to attend to the significant features of the task long enough for comprehension to occur.
3. Presence of fatigue, stress, anxiety, or other similar factors.
4. Inability to shift attention from one set of stimuli to another.
5. Presence of sensory deficits that interfere with attention.

Both language impaired and learning disabled children have been shown to have attention deficits (Berry, 1969; Sanders, 1977). According to Aram and Nation (1982), many writers note the

occurrence of these deficits, but surprisingly little research has been directed to support these observations. The authors believe that the cause and basis of attentional deficits remain unknown.

Auditory Rate

The rate at which auditory information is presented appears to be a variable related to the ability to understand language (Aram & Nation, 1982). This operation, which involves the processing of rapidly occurring acoustic information, is a developmental ability reaching a plateau by 8½ years (Tallal, 1976). When this function fails to develop normally in a child or is disrupted by damage to the dominant cerebral hemisphere of the brain, acquisition of normal language is also disrupted (Tallal, 1976).

Children with deficits of auditory rate appear to have problems accommodating to rapid temporal patterns of acoustic input (Aram & Nation, 1982). An impaired rate of auditory processing has been cited as a possible cause in developmental dysphasia (Tallal & Piercy, 1974) and has been hypothesized by educators to underlie language impairment in children (Lubert, 1981). Thus, auditory rate plays a significant role in the overall auditory processing chain of events with deficits resulting from an inability to adapt to various presentation rates of auditory information.

Auditory Discrimination

The auditory discrimination operation is considered prelinguistic because speech sounds may be distinguished one from another without comprehension by the listener (Aram & Nation, 1982).

Differentiating between sound patterns depends upon the correct

identification of the temporal relationships of both frequency and intensity components and the cues arising from coarticulatory functions (Sanders, 1977). Within this operation, Aram and Nation (1982) include phonetic, phonemic and phonologic discrimination and programming.

Disorders within the auditory discrimination operation may occur as the result of various interferences (Bangs, 1968) such as past experience, immediate set, physiological experiences during the discriminatory process, condition of the auditory pathways, and nature of the message. Determining which interference causes an inappropriate response is not always possible (Bangs, 1968).

The ability to discriminate speech in the presence of noise or a competing message may be difficult for some children (Bangs, 1968). This problem in turn may be the cause of delayed acquisition of language. Aram and Nation (1982) remain skeptical about forming any conclusions regarding the relationship of auditory discrimination to language disorders in children. More research is needed concerning this operation before its contribution to language and learning is known.

Auditory Sequencing

The ability to hold information in the order of presentation is attained through the operation of auditory sequencing (Aram & Nation, 1982). The importance of temporal ordering of pattern components is a determining factor of meaning at all levels from the morpheme to the sentence (Sanders, 1977). Sequencing is intimately related to the structural rules of language processing,

because it is these rules which determine the order in which segments can occur (Sanders, 1977).

Any disruption of the auditory sequencing operation will produce a disorder in perception of temporal sequence (Aram & Nation, 1982). Sequencing problems may be manifested in the reproduction of rhythmic structures of nonverbal acoustic patterns or in suprasegmental components of speech (Sanders, 1977). According to Fisher (1982), auditory sequencing skills appear to break down in a somewhat consistent manner: (a) confusing the sequence of words within a sequence; (b) substituting words or phrases; (c) omitting words or phrases; or (d) remembering only the last word or two of an entire sequence of sentences or instructions.

Auditory sequencing and auditory memory are closely related (Fisher, 1982). Any study of auditory sequencing cannot be isolated from other operations, most notably memory (Aram & Nation, 1982). For a child to have the ability to sequence incoming stimuli, the skill to hold these in memory must be present.

Auditory sequencing is an important component within the auditory processing model because sequential skills are necessary for the acquisition of language skills (Witkin, 1971). Deficient auditory sequencing has been observed in both the learning disabled (Aten, 1974; Aten & Davis, 1968) and the language impaired populations (Monsees, 1961, 1968). Although assessment of pure sequencing abilities may be difficult, disruptions within this operation may prove detrimental to language and academic learning.

Auditory Memory

The ability to remember auditorily presented information is likely to be the most significant factor of the auditory processing chain of events (Fisher, 1982). Meaningful messages require that incoming information be held temporarily in storage and associated with other information already within the repertoire of the receiver (Wood, 1975). This process involves the total memory operation which is divided into the components of short-term and long-term memory. Although long-term memory plays a crucial role in the accurate storage and retrieval of messages, it is the short-term memory which plays the active role, allowing stimuli to be copied into a more permanent form. Children with memory deficits experience much greater difficulty and frustration with short-term memory skills than with long-term memory skills (Fisher, 1982). Without an intact short-term memory system, the permanent storage of aurally presented information would be hindered. For this reason, the present research concentrates on short-term memory skills of language impaired and learning disabled children.

Short-Term Memory

The acoustic world is perceived not as it is, but rather according to how it is processed (Sanders, 1977). Auditory memory is involved with virtually every task associated with perception, processing and reproduction of sound (Heasley, 1980). Specifically, short-term memory is of great importance as exemplified by Olson's (1973) statement that, "Without temporary storage, there

would seem to be no way one could speak or understand the speech of others" (p. 146).

Significance of Memory

Bloom and Lahey (1978) noted that a child's development of language content depends on the interaction between knowledge and content. This interaction constitutes information processing whereby like events are related and generalizations are formed to be represented in memory. As a child grows older, memory is used to process and understand spoken language, to recall other people's messages, and to link language that is heard, spoken and written (Wiig & Semel, 1980). It is commonly accepted that the temporal lobes of the brain, including the limbic system, play an important role in memory function (Lemme & Daves, 1982). According to Berry (1969), if this memory function is defective, language learning will be impaired because the electrochemical basis of memory seems to parallel that of learning.

Memory plays a significant role in a child's day-to-day school routine. In order to succeed in school, a child must remember what the teacher said, the rules for recess games, the words on the page, and the end of the sentence he or she has just begun to write. Most children follow these activities without problems, however, there appear to be some who continually forget and therefore do not succeed in school. Children with deficit memory abilities may fail not because of an inability to do these tasks, but because directions and content cannot be held in memory suffi-

ciently (Johnson & Blalock, 1982). Ring (1975) estimated that 3 to 15 percent of the children who are not succeeding in school usually do poorly on memory tests.

The significance of memory deficits in children should lead educators to evaluate these abilities more thoroughly. Myklebust (1971b) stated:

Though it is often difficult, the diagnostician has no more important responsibility than to determine the integrity of those capacities requisite for storage of information. (p. 1209)

Assessment of memory would therefore include tasks to evaluate both short-term and long-term memory.

Atkinson and Shriffrin (1971) equated short-term memory with consciousness, because thoughts and information in current awareness are considered to be part of the contents of this short-term store. Since short-term memory is the first level at which conscious control can be exerted over information (Sanders, 1977), it is known as a working memory. It is the place where information enters and strategies are imposed (Atkinson & Shriffrin, 1971; Klatzky, 1975). The highest level of storage is known as long-term memory which is assumed to be a relatively permanent memory from which information is not lost (Atkinson & Shriffrin, 1971).

In summary, the importance of memory has best been captured in a statement by Johnson and Myklebust (1967): "As a psychoneurological function, memory is all encompassing, being entailed in essentially all mental functions" (p. 39). Short- and long-term memory are both crucial for language and academic learn-

ing in children. Though both memories complement each other in the storage process, short-term memory is considered in the present study because of its working capacity.

A Model of Memory

Atkinson and Shriffrin (1971) noted that the division of memory into two components dates back to the 19th century. Their model of memory adds a third structural component to the traditional two: a sensory register, a short-term store, and a long-term store. The Atkinson and Shriffrin (1971) model was adopted in the present study because it emphasizes the importance of the short-term system.

The overall model is best described by the flow of information through the memory system (Atkinson & Shriffrin, 1971). The flow begins as environmental input entering the system through sensory registers, either visual, auditory, or haptic. At this stage, stimuli are maintained for up to several hundred milliseconds. Once the input has been registered, it enters into short-term store where conscious control processes regulate the transfer of information in to and out of the long-term store. Associated information that is in the long-term store may be activated by the control processes and re-enter into the short-term store.

The processes carried out in the short-term store allow information to be held from a brief period of a few seconds to, at the very most, a few minutes (Gerber & Mencher, 1980). Short-term store may contain a great deal of information at any given moment (Shriffrin, 1976), but most of this information will be lost

virtually at once unless active control processes are imposed. According to Atkinson and Shriffrin (1971), these control processes are selected at one's own discretion and may vary not only with different tasks, but also from one encounter with the same task to the next. Three of the primary control processes are rehearsal, coding and imaging.

Rehearsal, the most commonly used control process, involves the repetition of items either covertly or overtly. In its simplest form, it is a repetitious cycle through which a sequence of information is rehearsed, always in the same order (Shriffrin, 1976). By rehearsing one or more items, each can be prolonged in short-term memory. However, the number of items that can be maintained in this manner is strictly limited and has been referred to as short-term rehearsal capacity (Shriffrin, 1976). According to Miller (1956), short-term memory span is usually within the realm of plus or minus seven chunks. Shriffrin (1976) observed short-term memory rehearsal span to be approximately eight items. This span is highly dependent upon active chunking which is defined as "a group of closely spaced items preceded and followed by longer temporal spaces" (Shriffrin, 1976, p. 203).

Shriffrin (1976) differentiated between rehearsal span of various types of stimuli. Rehearsal capacity for running span (connected organized material as in sentence) ranged from 7 to 14 words. In a recall task, when length of input exceeds rehearsal span, a rehearsal buffer is used. The buffer in the short-term store is set up so that it can hold only a fixed number of items

and the information held within is constantly changing. At the beginning of the recall task, the buffer is empty and successive items are entered until the buffer is filled. As each new item enters the rehearsal buffer, it replaces one of the items already present. The item replaced is determined by a random process. The items which continue to be rehearsed in the short-term store when the last item is presented are the ones that are immediately recalled by the subject (Atkinson & Shriffrin, 1971).

The control processes of coding and imaging are used to a lesser degree than rehearsal. Coding is defined as a process in which information to be remembered is put into a context which is easily retrievable, such as a mnemonic phrase (Atkinson & Shriffrin, 1971). In imaging, verbal information is remembered through visual images (Atkinson & Shriffrin, 1971).

Short-term memory is an important part of the overall memory system as exemplified by the model of Atkinson & Shriffrin (1971). Memory span as well as control processes is crucial for the flow of information through the memory stores. Without a short-term memory system, learning would be impossible.

Memory Limitations of Children

Ornstein and Naus (1978) reported that one of the most consistent findings in the field of memory development is that older children recall more than younger ones. Some educators, such as Ring (1975), believe that memory span increases as the child matures. Others, such as Huttenlocher and Burke (1976), believe that the developmental increase in the span of recall is associated

with the speed with which subjects can identify incoming items, not an increase in storage capacity. Memory deficits in children may be explained in terms of poor control processes within the short-term memory system (Chi, 1976) or an inability to handle verbal information rather than deficiencies in memory or information processing (Olson, 1973).

The bulk of research on memory and children tends to focus on strategies or control processes used to enhance short-term memory. Researchers are generally in agreement that memory per se cannot be improved, but by imposing strategies for remembering and recall, the amount of information which may be retained can be improved (Bangs, 1982). According to Baddeley (1976), memory span may exceed the capacity of the short-term store when it takes greater advantage of rehearsal.

Various studies have been conducted to evaluate the importance of the rehearsal strategy in the retention of information. Meunier, Ritz, and Meunier (1975) concluded that when rehearsal of items was allowed, retention was nearly perfect. Keeney, Cannizzo, and Flavell (1967) found that the serial recall of nonrehearsers was significantly poorer than that of rehearsers, again emphasizing the importance of rehearsal.

Educators have researched the rehearsal strategy in children and most appear to agree that, although present, the strategy is underdeveloped. In a study of the memory abilities of children and adults, Cuvo (1975) observed that children engaged primarily in maintenance rehearsal, while adults engaged in both maintenance and

elaborative rehearsal. Young children tended to rehearse only the last item presented, whereas older children and adults reentered items into subsequent rehearsal sets for additional rehearsal. Daehler, Horowitz, Wynns, and Flavell (1969) also found that younger children did not invoke the rehearsal strategy as readily as older children. Verbal rehearsal was more an intentional and planned cognitive strategy, selectively employed, which young children appeared not to use well.

In opposition to explaining reduced memory in children on the basis of deficient strategies, experiments by Craik and Watkins (1973) showed that overt rehearsal of an item was not related to subsequent recall. These authors believed that maintenance rehearsal did not lead to improvement in memory performance. Similarly, Huttenlocher and Burke (1976) found no positive support for age related increases in span due to the appearance of strategies.

There are obvious differences in the memory abilities of children and those of adults. Whether these stem from immature strategy processes, memory span growth, or any number of other underlying maturational factors depends upon the investigator's personal preferences and beliefs, but discrepancies remain. Numerous children exhibit memory deficits when compared not only to adults, but also to peers their own age. When this discrepancy is present, disruptions within the memory system have occurred causing children to forget and fostering learning problems.

According to Reitman (1971), theories of forgetting in short-term memory include one or more of the following four basic

operating principles: (a) displacement, (b) decay, (c) associative interference, and (d) acid-bath interference. Displacement is accomplished by removing already stored inputs from a limited capacity buffer store and replacing them with new inputs. This produces forgetting (Waugh & Norman, 1968). The decay theory proposes loss of information due to time without rehearsal (Baddeley, Thomson, & Buchanan, 1975). Keppel and Underwood (1962) noted that associative interference causes forgetting because associations learned prior to the learning of associations for which retention is being tested may interfere with recall. In acid-bath-interference, rate of information loss is a function of both the amount of acid (number of store items) and concentration (similarity) (Posner & Konik, 1966).

In a study by Reitman (1974), the existence of both decay and displacement in short-term forgetting was supported. This phenomenon of forgetting occurs almost everyday in both adults and children. It may range from the forgetting of a phone number from the time it is looked up until it is dialed to forgetting a mathematical rule that was just reviewed. However, forgetting information appears to be more prevalent in some children, than in others.

Evaluation of Auditory Processing Problems

Stubblefield and Young (1975) stated,

The necessity for a method of early detection of elements in central auditory dysfunction is urgent since each year lost during the critical early readiness years is irretrievable in terms of learning achievement, language development and personality adjustment. (p. 89)

Four approaches to evaluating auditory processing disorders have been identified by Fisher (1982), including the evaluation of:

1. Processing deficits with a battery of site of lesion tests.
2. Specific components of auditory processing.
3. Processing problems with speech and language.
4. Academic deficiencies in areas such as reading and mathematics.

Interest in the auditory processing performance of language/learning disabled children by various audiologists has sparked an increasing use of site of lesion tests. Significant disruptions in the ability to understand auditory signals have been found to exist in persons with acquired temporal lobe lesions (Bangs, 1968). Willeford (1976), one of the leading proponents of site of lesion testing with the learning disabled, has developed four tests which have been successful in differentiating normal from learning disabled children. These site of lesion tests include: (a) competing sentence (one sentence presented in the right ear and a different sentence presented simultaneously in the left); (b) filtered speech (discrimination of selected words); (c) binaural fusion (low-band and high-band segments presented to each ear); and (d) alternating speech (sentences switched alternately between the two ears).

The Staggered Spondiac Word Test (SSW), developed by Katz (1972), has also been found to differentiate between learning disabled and normal children (Stubblefield & Young, 1975). The

SSW is a dichotic listening procedure in which different speech stimuli are presented to each ear simultaneously as competing messages. Stubblefield & Young, (1975) concluded that the incidence of reversal-type errors appeared to be a valid indicator of central auditory dysfunction in younger children. The SSW was successful in identifying these children with learning disabilities.

In the present study, the second and third of Fisher's (1982) approaches to the assessment of auditory processing disorders have been employed by extracting short-term memory from the complete model and evaluating it through speech and language measures. According to Ring (1975), memory can only be assessed by inference because it cannot be seen, touched or smelled. So, how a memory works is inferred from the differences between what is offered as a stimulus and what is given as a response (Ring, 1975). Numerous studies have reported using various types of memory tasks. Johnson and Blalock (1982) suggested that the auditory memory battery contain both nonverbal and verbal responses to determine whether deficits are in input, storage or output. The present research assessed short-term memory abilities through six tasks recommended by Culbertson (1981), Fisher (1982), Myklebust (1971b), and Wiig and Semel (1980): digit repetition, word and sentence repetition, execution of commands, extraction of meaning from spoken paragraphs, and the synthesis of syllables.

Short-Term Memory and Learning Disabilities

Children with learning disabilities represent a complex heterogeneous group of individuals whose underachievement may be related to disturbances in one or more of the auditory processing skills (Johnson, 1981). According to Gerber and Mencher (1980), disruptions in any one or more of the aspects within the auditory processing chain of events may result in a moderate to severe learning disability. Fisher (1982) hypothesized that if an evaluation of a large number of learning disabled students at all grade levels were conducted, results would likely find at least half of this population with significant difficulty in one or more aspects of auditory processing.

Short-term memory plays a vital role within auditory processing. Heasley (1980) reported that individuals with short-term memory deficits may experience severe learning difficulties. The failure to remember academic material that is presented under normal conditions of classroom instruction appears to be a universal problem among the learning disabled population (Torgesen, 1981). This fact is emphasized by Wiig and Semel (1980) who noted that learning disabled children and adolescents consistently demonstrated short-term memory deficits. Gerber and Bryen (1981) identified the following as characteristic of memory problems in learning disabled children: (a) general impairment of auditory memory and comprehension including problems of attention, (b) difficulty in following oral directions, (c) problems with processing and recall of critical details, and (d) deficient comprehension of basic vocabulary and concepts used in the classroom.

Although learning disabled children are not a homogeneous group and it is difficult to find patterns in their performance on psychometric tests, to a certain extent, they all have difficulty on one or more kinds of memory tasks (Ring, 1975). In a study of learning disabled and normal children, Elkins and Sultmann (1981), found a large coefficient of discriminant function between the groups on the Auditory Sequential Memory Subtest of the Illinois Test of Psycholinguistic Abilities (Kirk, McCarthy, & Kirk, 1968) with the learning disabled performing more poorly. Cohen and Netley (1981) also found that learning disabled children performed worse than controls on digit span tests.

In one study by Torgesen and Houck (1980), learning disabled and normal children were required to repeat digits, animal names and nonsense syllables. Recall was similar for the learning disabled and normal group on nonsense syllables, but different on digits and words. The learning disabled group consistently scored below the normal group with respect to the entire battery, supporting the claim that learning disabled children have problems with certain memory tasks.

The receptive and expressive linguistic abilities of children with learning disabilities has been researched through the years with respect to memory. In regard to the receptive ability of language processing, Wiig and Roach (1975) suggested that learning disabled adolescents depend heavily upon semantic aspects and experience immediate memory problems for modifier strings. Ceci, Ringstrom, and Lea (1981) believed that these specific types of

memory impairments were associated with diminished semantic processing. Expressively, Bartel, Grill, and Bartel (1973) reported that children with learning disabilities were unable to demonstrate their true linguistic ability, because this skill is observed and measured over time and memory deficits could easily mask the true competence of these children. Wiig, Semel and Crouse (1973) supported this finding through a study which revealed that morphological and syntactic deficiencies in learning disabled children reflected limited auditory memory. Bartel et al. (1973) believed this linguistic deficit occurred due to the considerable lapse of time between the beginning and end of an utterance. During this time, learning disabled children may not be able to perform linguistically in such a way to give a reasonable estimate of linguistic competence.

Lapointe (1976) used the Token Test for Children (DiSimoni, 1978) to investigate potential language processing deficits in learning disabled adolescents. The results of his study suggested that these deficits, which persisted into adolescence, were due to slower processing of embedded sentences which place a heavier load on memory and result in the loss of the initial clause. The author concluded that the Token Test for Children, in its complete form, was a good instrument for the differential diagnosis of language processing difficulties in combination with memory deficits for learning disabled children.

Auditory memory deficits in children may produce an inability to remember letter sounds or to synthesize sounds to make words (Johnson & Myklebust, 1967). This skill, known as sound blending (Kass, 1972), is especially critical when learning to read. The result of sound blending problems is a marked number of letter reversals when writing (Gerber & Mencher, 1980). With this in mind, The Phonemic Synthesis Test (Katz & Harmon, 1981a) which involves memory for sound blending, was used in a study of 183 learning disabled children by Katz, Chubrich, Davis, Gallaway and Illmer (1969). This unpublished study, which was reported by Katz and Harmon (1981b), revealed that 77 percent of the learning disabled children had auditory processing problems on The Phonemic Synthesis Test. The children with problems in reading and spelling performed the poorest on the test and were also approximately 2 to 2½ years behind in language development. The authors believed that these results demonstrated the close relationship between phonemic synthesis and language skills in learning disabled children with reading and spelling problems.

The short-term memory problems of learning disabled children not only affect the ability to repeat digits, sentences and oral commands on tests, they also affect the ability to remember and follow spoken directions accurately and to recall details and sequences of information accurately. Some children with learning disabilities may leave out words, phrases, or clauses in spoken directions, or they may substitute word opposites in spoken directions (Wiig & Semel, 1980). However, the severity of the deficiency may extend beyond these observable problems.

Short-Term Memory and Language Impairment

The ability to use a language system for purposes of communication is crucial for academic success. Aram and Nation (1982) emphasized the importance of language to school achievement when they stated:

A major accomplishment of most children during their preschool years is developing an effective, highly elaborated language system. Language learning is a pivotal accomplishment, both as a channel to demonstrate more general cognitive development and as a fundamental skill underlying much future learning, particularly during the school-aged years. (p. 50)

Most children develop an adequate language system without problems, however, there are some who do not. According to a Committee Report in ASHA (1979), a child with a language impairment demonstrates problems in language knowledge and use, as well as disruptions in higher order thinking in the learning of school curriculum and the management of the language of instruction.

The processing of information gleaned from the environment begins as soon as a child is born. Exactly how the information is gradually represented in memory is a complex and somewhat mystical phenomenon, but one that has everything to do with language development. The importance of memory to language learning was stressed by Masland and Case (1968) who reported that the syntactic aspect of language was learned partly by remembering the order of words. Therefore, any interference with children's ability to remember sequences might interfere seriously with syntactic order. Graham (1968a) also emphasized the link between memory and language acquisition, noting that children who failed to acquire language rules might exhibit certain deficiencies such as memory.

In recent years, speech and language clinicians have been increasingly confronted with children who exhibit language disorders in the absence of any obvious underlying factor such as hearing loss, mental retardation, emotional disturbance, or peripheral structural defects (Lubert, 1981). Their language problems have been attributed to numerous causal factors, but traditionally have been viewed as related to auditory processing deficits in general (Stark & Tallal, 1981), and to memory deficits specifically. Aram and Nation (1982) reported that all of the classic writers in child language disorders suggested that memory dysfunctions contributed to disordered language in children.

The language impaired population appears to have received little attention with respect to memory. Although numerous authors have stated opinions concerning the memory abilities of language impaired children, there is little research in support of their statements. Johnston (1982) reported that investigations of perceptual processes within the language disordered population are as yet scattered and inconclusive. She believed that research in sequencing and memory had failed to expose any global underlying auditory processing deficit.

A few studies, however, did find some memory deficits in the language impaired. Weiner (1969) concluded that in comparison with normal children, language impaired children fared significantly poorer in all auditory modality tests. Menyuk (1964) also found that the ability to repeat orally presented stimuli differed strikingly between language impaired and normal children. She

reported that children with deviant speech repeated with omissions or repeated the last words of sentences. In a later study, Menyuk and Looney (1972) hypothesized that poor repetition of sentences by language impaired children might be related to limits on short-term memory which did not allow for storage of the complete phrase or sentence. Menyuk and Looney (1972) believed that differences in sentence repetition skills of language impaired and normal children appeared to be a function of memory.

Graham (1968b) also studied short-term memory in language impaired children and concluded that short-term memory limitations might well account for some of their language deficiencies. He reported that children failed to process sentences which made demands beyond their short-term memory capacity. Butler (1981), however, noted that children with language impairment demonstrated difficulties not in capacity, but in clustering or organizing items categorically. Within the realm of language impairment, aphasic children appear to have been researched to a greater extent than others, and most studies have concluded that developmentally aphasic children have deficient short-term memory skills (Albert, 1976; Eisenson, 1972; Johnson & Myklebust, 1967; Stark, Poppen, & May, 1967).

Explanations have been offered relative to the relationship between memory and language impairment. According to Aram and Nation (1982), many researchers hold that memory problems cause the language problems (the bottom-up theory). Others argue that the

language impairment causes the memory deficit (the top-down theory). Still others link impairments of memory and language not to each other, but rather to a third factor such as a more general failure for hierarchical abstraction and storage (Aram & Nation, 1982). Evidence is inconclusive in each school of thought, emphasizing the need for future research with the language impaired population. Aram and Nation (1982) stated:

Continued research into how language disordered children process or fail to process information will be needed before researchers can conclude what relationships exist between auditory memory and child language disorders. (p. 104)

A Comparison of Memory Abilities in Learning Disabled
and Languaged Impaired Children

Studies which compare short-term memory of learning disabled and language impaired children are not available, however numerous authors have alluded to the fact that the two groups are similar in their overall abilities. Fisher (1982) noted that there are very few children who experience learning disabilities who do not also have some degree of difficulty with oral language skills. Katz and Harmon (1981b) observed that speech and language problems frequently accompany reading and spelling problems. Children with language disorders, just as children with learning disabilities, are at high risk for academic failure of varying degrees and types (Committee Report, 1979).

Wiig and Semel (1980) further linked the memory skills of learning disabled and language impaired in their statement that, "Language and learning disabled youngsters may have difficulties in

retaining and recalling details in spoken messages or in recalling oral directions" (p. 314) Before such comments can be substantiated, further research is needed.

Processing Problems: Fact or Fallacy

The most outspoken author against auditory processing disruptions as a cause of language and learning disabilities is Rees (1981) who stated, "auditory processing disturbances have become the iron bed into which all sorts of language and learning deficits are made to fit" (p. 94). Rees (1973) presented a cursory review of the literature in language and learning disabilities, which revealed a continuing conviction that auditory processing factors are intimately involved with problems such as defective articulation, aphasia, dyslexia, and specific learning disabilities. Conclusions drawn by Rees (1973) from the review were that the search for a single auditory skill, or even a set of auditory abilities essential to language learning, or impaired in all or most language disordered children seems futile.

Rees (1981) believed that the auditory processing approach lacks a clear model to account for the role that specific abilities play in acquiring and manipulating language, and in using language for academic learning. She presented the following questions in lieu of her skepticism:

1. If auditory sequencing is to be assessed, we must first ask sequencing of what?

2. Assessing auditory memory span in children is based on the assumption that a child needs a given size of memory span in order to do what?

3. Is there a relationship between the ability to identify rapidly changing acoustic spectra in speech discrimination tasks and language learning?

4. Does the child need a certain level of ability to recognize speech presented in alternating fashion to the two ears in order to learn in the classroom?

The wealth of statements and studies which try to provide answers for these questions, according to Rees (1981), suffer from internal inconsistencies with respect to experimental findings and logical argument. Rees (1981) observed that an auditory processing model which satisfies the relationship of presumed requisite abilities to language acquisition and learning has neither been proposed nor tested.

Rees (1981), as well as other authors, view processing problems of children as a top-down phenomenon -- that language influences auditory processing ability -- rather than a bottom-up phenomenon in which auditory processing problems create language and learning disabilities (Aram & Nation, 1982). In support of Rees (1981) and the top-down theory, Leonard (1979) stated:

The very nature of the restricted speech used by language impaired children seems to suggest that auditory processing deficits may be corollary to rather than a cause of language difficulties. (p. 227)

According to Aram and Nation (1982), educators must maintain alternative perspectives on the causal relationship of auditory processing disruptions and child language disorders. Disabilities in children which warrant special education such as learning disabilities, auditory processing problems, and language impairment

are more likely to be found in the thinking of the classifiers than in the behaviors of the children (Kleffner, 1975). In addition, it seems likely that most (if not all) of the children classified as having auditory processing or learning disorders, will present some evidence of language impairment relative to other abilities (Kleffner, 1975).

There have been and will most likely continue to be controversies between proponents of the top-down and the bottom-up theories. Language impaired children, as well as learning disabled children constitute heterogeneous rather than homogeneous groups. It appears more relevant that educators view auditory processing from a middle ground. Although disrupted auditory processes are noted in some children with various disabilities, these disruptions will not always be present in every child with the same disability.

Summary

According to Aram and Nation (1982), auditory processing encompasses five specific operations: (a) auditory attention, (b) auditory rate, (c) auditory discrimination, (d) auditory sequencing, and (e) auditory memory. The operation of auditory memory was extracted from the total processing system because of its importance in language and learning acquisition. Normal children's memory capacities are not as well developed as those of adults, and there appear to be some children whose memory abilities are inferior when compared to their own peers. Although learning dis-

abled children appeared to exhibit deficits in memory, language impaired children have been researched so little in this area that this observation may or may not apply. Research linking these two groups of children was non-existent.

Chapter 3

DESIGN OF STUDY

In this chapter, the participants of the study are identified and defined, the instruments are described, and the statistical methods for analyses of the data are explained.

Participants of Study

The participants included in the study were 14 learning disabled and 14 language impaired children matched on the basis of age (plus or minus six months), intelligence quotient (plus or minus ten points), and reading achievement (plus or minus six percentile points). All subjects were selected from the first, second, third or fourth grades in the Davidson County School System of North Carolina and all were receiving special services at the time of the study but no child was enrolled in both the learning disabled and language impaired programs.

To be included in the study, all children were required to achieve an IQ of 85 or better on the Slosson Intelligence Test for Children and Adults (SIT), (Slosson, 1978). The SIT is a screening instrument which evaluates mental ability and requires approximately ten to fifteen minutes for administration. The concurrent validity of the SIT was established by a high correlation with the Stanford-Binet Intelligence Scale (Terman &

Merrill, 1960). Independent testing of 141 subjects revealed a coefficient correlation of .92 for the ages of 4 through 19 years. A reliability coefficient of .97 was obtained for the SIT on 139 individuals from ages 48 to 50 years old with the test-retest interval being a period of two months.

Children were also matched for reading achievement on the basis of previously administered tests. The Prescriptive Reading Inventory (PRI) of the North Carolina Annual Testing Program (CTB/McGraw-Hill, 1976) was used for the first, second, and third graders. The California Achievement Test (CTB/McGraw-Hill, 1978) was used for children in the fourth grades. The PRI yields a predicted California Achievement Test percentile which was used for this study.

Prior to participation in the study, all parents of children were notified of the selection of their child for this project (see Appendix B) and a signed permission for participation (see Appendix C) was obtained. Normal hearing acuity was established for all subjects through routine audiometric screening at 20 dB for the frequencies 1000Hz, 2000Hz, 4000Hz, and 6000Hz, and 25 dB for the frequency 500Hz.

For a description of pertinent subject characteristics, see Tables 1 and 2.

Learning Disabled Group (LD)

For the purpose of this study, a learning disabled student was defined as:

Table 1
 Pertinent Characteristics of the
 Learning Disabled Group

Subject	Age in Months	Sex	<u>SIT</u>	Reading Achievement %ile
15	104	Male	104	35
16	118	Male	90	01
17	109	Male	99	11
18	93	Male	113	26
19	96	Male	97	11
20	104	Male	88	26
21	106	Male	101	26
22	113	Male	88	01
23	110	Male	92	34*
24	98	Male	89	29
25	127	Female	89	39*
26	124	Male	87	23
27	113	Male	96	04
28	92	Female	96	06
RANGE	92-127		87-113	1-39
MEAN	108		95	19

SIT - Slosson Intelligence Test for Children and Adults

Reading Achievement %ile - as obtained from the Prescriptive Reading Inventory

*Reading Achievement %ile - as obtained from the California Achievement Test

Table 2
 Pertinent Characteristics of the
 Language Impaired Group

Subject	Age in Months	Sex	<u>SIT</u>	<u>TOLD</u>	Reading Achievement %ile
1	99	Male	105	79	38
2	112	Male	88	79	03
3	104	Male	98	83	12
4	91	Male	104	63	29
5	94	Male	87	78	15
6	99	Male	91	82	35
7	109	Male	97	81	24
8	113	Female	87	72	01
9	106	Male	90	72	36
10	98	Female	92	83	23
11	124	Male	89	80	34
12	124	Male	85	85	26
13	109	Male	101	82	05
14	94	Male	88	67	10
RANGE	91-124		85-105	63-85	1-38
MEAN	105		93	78	21

SIT - Slosson Intelligence Test for Children and Adults

TOLD - Test of Language Development

Reading Achievement %ile - as obtained from the Prescriptive Reading Inventory

A pupil who has a severe discrepancy between ability and achievement and has been determined by a multi-disciplinary team not achieving commensurate with his/her age and ability levels. The lack of achievement is found when the pupil is provided with learning experiences appropriate for his/her age and ability levels in one or more of the following areas: oral expression, listening comprehension, written expression, spelling, basic reading skill, reading comprehension, mathematical calculation, or mathematical reasoning. The team does not include pupils whose severe discrepancy between ability and achievement is primarily the result of a visual, hearing, or motor handicap, mental retardation, emotional disturbance, or environmental, cultural, or economic disadvantage. (North Carolina Department of Instruction, 1981, p. 3)

Children in the LD group met requirements for placement in the learning disability program as established by the Davidson County School System (see Appendix A) and at the time of the study were currently enrolled in the program within their respective schools.

Language Impaired Group (LI)

According to Weiner (1974), language impairment is defined as:

A group of conditions characterized by the late appearance or slow development of language in children who do not have sensory, motor, emotional, or general intellectual deficits that might be considered basic to their difficulties. (p. 2020)

Children considered for the LI group were currently receiving language therapy from a speech and language clinician. All were administered the Test of Language Development (TOLD) (Newcomer & Hammill, 1977) to insure a language deficit (language quotient: 85 or below). The TOLD, a comprehensive screening instrument, was selected because it tests both receptive and expressive language abilities and yields an overall language quotient. Seven speech and language clinicians within the Davidson County School System

administered the TOLD to children within their respective schools. The TOLD was standardized on an unselected sample of 1014 children residing in fifteen states. The concurrent validity of the total score on the TOLD for three age levels was supported through a correlation analysis with the Test for Auditory Comprehension of Language (Carrow, 1973). The resulting coefficients were .63, .72 and .73 depicting substantial validity. Test-retest reliability coefficients after an intervening period of five days exceeded .80 on each subtest of the TOLD, indicating high stability.

Instruments

A battery of six tests was selected to assess various short-term memory abilities, including: the Auditory Sequential Memory Subtest of the Illinois Test of Psycholinguistic Abilities (Kirk, McCarthy, & Kirk, 1968); the Auditory Attention Span for Unrelated Words and the Auditory Attention Span for Related Syllables, both of the Detroit Tests of Learning Aptitude (Baker & Leland, 1967); The Token Test for Children (DeSimoni, 1978); the Processing Spoken Paragraphs Subtest of the Clinical Evaluation of Language Functions (Semel & Wiig, 1980); and The Phonemic Synthesis Test (Katz & Harmon, 1981a).

Auditory Sequential Memory

Children's ability to recall and repeat forward digit series was tested with the Auditory Sequential Memory Subtest from the Illinois Test of Psycholinguistic Abilities (Kirk, McCarthy, & Kirk, 1968), a test of the number of unrelated units which can be retained for immediate sequential recall and repetition. This

subtest contains 28 digit series which range in length from two to eight digits (see Appendix D). Digit series were administered at a rate of one digit per second, instead of the recommended two per second by the authors to insure compatibility with other tests used in this study. Scoring was accomplished by awarding two points for each item repeated exactly as it was modeled, with the maximum possible points being 56.

The Illinois Test of Psycholinguistic Abilities (ITPA) (Kirk, McCarthy, & Kirk, 1968) was standardized on a sample of 962 children in the age range of two to ten years. Intercorrelations of the Auditory Sequential Memory Subtest with other subtests of the ITPA ranged from .06 to .28. It appears that this test emerges as an independent factor in the battery, since its correlation with the rest of the tests is negligible. Test-retest reliability coefficients, after a five-month interval, ranged from .75 to .89, with an increase in stability as a function of age. Split-half correlation coefficients indicated that internal consistency of items ranged from .74 to .95 and increased with age.

Auditory Attention Span for Unrelated Words

The Auditory Attention Span for Unrelated Words Subtest of the Detroit Tests of Learning Aptitude (Baker & Leland, 1967) evaluates short-term memory for unrelated words. This subtest contains 14 word series which increase in length from two to eight words (see Appendix E), all of which are nouns which label persons, animals and objects. The word series were presented at the suggested rate of one word per second, and the children were

required to repeat the word series immediately after they were modeled. Two scores were obtained from this subtest: a simple score, in which one point was given for every word recalled in any order for a maximum of 70 points, and a weighted score in which the number of words correct in each span, regardless of order, was multiplied by the number of words in each span for a maximum score of 406.

Standardization of the Detroit Tests of Learning Aptitude (Baker & Leland, 1967) was accomplished on a sample of 150 children at each age level in the range from 3 to 19 years. Sixteen subtests were correlated with each other for 100 children ages 8 to 12 years with the majority of correlations falling between .2 and .4, indicating a fairly low yet positive correlation. Initially, test-retest reliability was measured using a sample of 48 children with a five-month interval between tests. The correlation coefficient was .96 indicating high stability over a short interval. A second correlation coefficient of .68 was reported for a group of 792 children in the age range from 7 to 10 years, tested within a two- to three-month interval.

Auditory Attention Span for Related Syllables

To assess short-term memory for varying numbers of syllables joined together as syntactically and semantically correct sentences, the Auditory Attention Span for Related Syllables Subtest of the Detroit Tests of Learning Aptitude (Baker & Leland, 1967) was used. This subtest evaluates the immediate recall and imitation of 43 model sentences (see Appendix F), which range in

length from 5 words (6 syllables) to 22 words (27 syllables). Each sentence was administered slowly and distinctly by the clinicians and the children were required to repeat the sentence verbatim immediately after it was modeled. Testing was terminated when the children failed three sentences in succession. A sentence was failed when three or more errors were present. The authors recognized three types of errors: (a) a word omitted, (b) a word added, and (c) an unsuitable word substituted. The following were criteria for scoring: (a) three points for each sentence without error, (b) two points for each sentence with one error, (c) one point for each sentence with two errors, and (d) no credit for sentences containing three or more errors. The maximum score possible was 129 points. For standardization, validity and reliability information on the Detroit Tests of Learning Aptitude (Baker & Leland, 1967) see Auditory Attention Span for Unrelated Words in this section.

The Token Test for Children

The Token Test for Children (DiSimoni, 1978) evaluates ability to retain, recall and execute a set of oral directions of increasing length and complexity and minimal redundancy. The test does not require a verbal response. The oral commands featured are executed by identifying or manipulating one or more of a set of 20 tokens which vary in color, shape and size. The Token Test for Children contains five parts, with the first four parts featuring one- and two-level commands which are presented for immediate action (see Appendix G). The last part (Part V) contains oral

directions which feature spatial, temporal, and conditional linguistic concepts and complex syntactic structures (see Appendix H). All parts were administered using the standardized method recommended by the author. Children's overall scores were determined by the number of correct responses, with one point awarded for each correct item. The maximum possible score was 61.

Standardization of The Token Test for Children (DiSimoni, 1978) was accomplished through a study of 1304 children who ranged in age from 3 to 12½ years. Validity was investigated by comparing performance on The Token Test for Children with the Peabody Picture Vocabulary Test (Dunn & Dunn, 1981) and the Preschool Language Scale (Zimmerman, Steiner & Pond, 1979). Correlations of .71 and .72 were found respectively, both of which were significant at the .001 level of significance (Lass & Golden, 1975). Cartwright and Lass (1974) compared children's scores on The Token Test for Children to scores on the Northwestern Syntax Screening Test (Lee, 1969) and obtained a correlation of .63, again demonstrating the statistical validity of using The Token Test for Children as a measure of receptive language function. Measures of test-retest reliability are not available.

Processing Spoken Paragraphs

To evaluate ability to retain information in paragraphs presented orally, the Processing Spoken Paragraphs Subtest of the Clinical Evaluation of Language Functions (Semel & Wiig, 1980) was administered. This subtest assesses the ability to process, interpret and recall salient information, including retention and

delayed recall of details such as proper names and numerical data. Each of the four paragraphs of increasing length and complexity (see Appendix I) and associated questions were administered by standardized procedures as recommended by the authors. The children were required to listen to these short paragraphs read by the clinicians and answer questions pertaining to the information. Two points were awarded for each question answered correctly with the maximum number of points being 34.

The Clinical Evaluation of Language Functions (Semel & Wiig, 1980) was standardized on a sample of 1378 students in grades kindergarten through grade 12. Concurrent validity was established by comparison with performances on existing criterion measures revealing the following coefficients of correlations: .59 with the ITPA (Kirk, McCarthy, & Kirk, 1968) Verbal Expression Subtest; .52 with the ITPA Auditory Association Subtest; .46 with the ITPA Auditory Sequential Memory Subtest; and .57 with the Expressive Subtest of the Northwestern Syntax Screening Test (Lee, 1969). The test-retest reliability of the Processing Spoken Paragraphs Subtest was evaluated with a sample of 30 randomly selected children ages eight years three months to eight years six months, with a six-week time interval between tests. Results revealed a correlation coefficient of .84 indicating adequate stability of performance over time.

Phonemic Synthesis

The ability to retain and synthesize (fuse together) individual phonemes of words which are spoken in the absence of

coarticulation was evaluated through The Phonemic Synthesis Test (Katz & Harmon, 1981a). In this test, phonemes are presented at a rate of one per second requiring the child to retain and combine each phoneme with the others to produce the synthesized word.

The Phonemic Synthesis Test (Katz & Harmon, 1981a) contains 25 words which vary in length from two to four phonemes (see Appendix J), and is administered using a pre-recorded cassette tape. Administration was accomplished via tape recorder located $1\frac{1}{2}$ to 2 feet from the children and turned to a comfortably loud level. The children's responses were scored correctly if the phonemes were synthesized and repeated exactly, but errors were recorded (see Appendix K). One point was awarded for each correct response with a maximum score of 25.

Standardization of The Phonemic Synthesis Test (Katz & Harmon, 1981a) was accomplished through a field study of 85 children in the first, second, third and fourth grades. Relationships between The Phonemic Synthesis Test and auditory memory were established by Katz, Chubrich, Davis, Gallaway and Illmer in a 1969 study which demonstrated a correlation of .47 between The Phonemic Synthesis Test and the memory portion of the Utah Test of Language Development (Mecham & Jones, 1977). Test-retest reliability information was not available.

Administration of the Test Battery

The test battery for each child was prearranged in a random order for presentation, with the exception of the Processing Spoken Paragraphs Subtest of the Clinical Evaluation of Language Functions

(Semel & Wiig, 1980). The entire CELF was administered as part of a separate but related study on the language skills of learning disabled and language impaired children (Moore, 1983). Both studies used the same participants.

The researcher was aided in the administration of the short-term memory battery by seven speech and language clinicians of Davidson County, who tested all children within their respective schools. Each clinician was trained individually by the researcher on administration procedures and a detailed written explanation accompanied each test to insure uniformity. Children were tested individually, with the entire battery administered in one 45-minute session. Each matched pair was tested within a time frame of three weeks.

Data Analysis

To compare the performance of the learning disabled and language impaired groups on each auditory memory test, six individual t tests were performed.

The Pearson product moment correlation was used to establish relationships within the two groups on the six tasks. The .05 level of significance was employed for the t tests and correlations.

Summary

A total of 28 children participated in this study, 14 learning disabled and 14 language impaired, who were matched on the basis of age, IQ and reading achievement. Participants were selected from the first, second, third and fourth grades in the Davidson County

School System of North Carolina and were currently being served in the special education area for which they were labeled. Six tests assessed the short-term memory abilities of the children including the Auditory Sequential Memory Subtest of the ITPA (Kirk, McCarthy, & Kirk, 1968); the Auditory Attention Span for Unrelated Words and the Auditory Attention Span for Related Syllables, both of the Detroit Tests of Learning Aptitude (Baker & Leland, 1967); The Token Test for Children (DiSimoni, 1978); the Processing Spoken Paragraphs Subtest of the Clinical Evaluation of Language Functions (Semel & Wiig, 1980); and The Phonemic Synthesis Test (Katz & Harmon, 1981a). Data were analyzed for significant differences between the groups using six t tests, and the Pearson product moment correlation was employed to determine relationships between performance on the battery within the two groups.

Chapter 4

RESULTS AND ANALYSIS

The results and analysis of the data are discussed in this chapter.

Results

The individual raw scores, means, standard deviations and ranges of the performance on the six short-term memory tasks for the learning disabled and language impaired children are presented in Tables 3 and 4.

The overall performance on the Auditory Sequential Memory Subtest of the Illinois Test of Psycholinguistic Abilities (ITPA) (Kirk, McCarthy, & Kirk, 1968) for the learning disabled group ranged between 18 and 30 with a mean of 24.9 and a standard deviation of 6.1. For the language impaired group, scores ranged between 10 and 26 with a mean of 19.4 and a standard deviation of 5.5.

The Auditory Attention Span for Unrelated Words of the Detroit Tests of Learning Aptitude (DTLA) (Baker & Leland, 1967) yielded both a Simple and Weighted score. The overall performance for the learning disabled group using the Simple score ranged between 31 and 53 with a mean of 40.9 and a standard deviation of 5.2. For the language impaired group, scores ranged between 23 and 45 with a mean of 34.9 and a standard deviation of 5.8. The overall

Table 3

Raw Scores for the Learning Disabled Group on Six Short-Term Memory Tasks

Subject	<u>ITPA</u>	<u>DTLA</u>		<u>DTLA</u>	<u>Token</u>	<u>CELF</u>	<u>Phonemic</u> <u>Synthesis</u>
	Auditory Sequential Memory	Unrelated Simple	Words Weighted	Related Syllables	<u>Test for</u> <u>Children</u>	Spoken Para- graphs	
15	18	31	162	35	47	10	8
16	18	38	194	57	57	12	5
17	24	40	215	48	50	4	14
18	18	40	201	37	50	16	7
19	28	42	219	40	41	4	5
20	26	42	220	45	40	18	12
21	28	42	204	69	51	13	19
22	40	53	283	63	52	6	7
23	22	46	239	69	57	26	12
24	26	35	168	44	53	6	18
25	28	37	185	45	53	18	5
26	18	40	205	40	47	6	7
27	24	41	212	50	55	12	7
28	30	45	242	51	53	10	7
Range	18-30	31-53	162-242	35-69	40-57	4-18	5-18
Mean	24.9	40.9	210.6	49.5	50.4	11.5	9.5
SD	6.1	5.2	31	11.2	5.2	6.4	4.7

ITPA - Illinois Test of Psycholinguistic AbilitiesDTLA - Detroit Tests of Learning AptitudeCELF - Clinical Evaluation of Language Functions

Table 4

Raw Scores for the Language Impaired Group on Six Short-Term Memory Tasks

Subject	<u>ITPA</u>	<u>DTLA</u>		<u>DTLA</u>	<u>Token</u>	<u>CELF</u>	<u>Phonemic</u> <u>Synthesis</u>
	Auditory Sequential Memory	Unrelated Words Simple	Weighted	Related Syllables	Test for Children	Spoken Para- graphs	
1	26	45	235	44	57	20	1
2	28	36	171	37	40	8	5
3	12	36	174	37	45	4	7
4	26	27	121	28	47	8	0
5	10	23	99	13	35	6	8
6	16	36	178	28	46	12	1
7	16	40	201	41	56	18	8
8	16	33	166	25	53	12	5
9	18	36	180	41	48	12	12
10	20	39	205	44	49	10	4
11	22	33	171	30	47	18	8
12	24	35	170	35	55	11	6
13	22	35	170	28	46	13	10
14	16	33	171	35	45	6	6
Range	10-26	23-45	99-235	13-44	35-57	4-20	0-12
Mean	19.4	34.9	172.3	33.3	47.8	11.3	5.8
SD	5.5	5.8	32.8	8.6	6.1	4.9	3.5
<u>ITPA</u> - Illinois Test of Psycholinguistic Abilities							
<u>DTLA</u> - Detroit Tests of Learning Aptitude							
<u>CELF</u> - Clinical Evaluation of Language Functions							

performance of the learning disabled group using the Weighted score ranged between 162 and 242 with a mean of 210.6 and a standard deviation of 31. The Weighted scores for the language impaired ranged between 99 and 235 with a mean of 172.3 and a standard deviation of 32.8.

The overall performance on the Auditory Attention Span for Related Syllables of the DTLA (Baker & Leland, 1967) for the learning disabled group ranged between 35 and 69 with a mean of 49.5 and a standard deviation of 11.2. For the language impaired group, scores ranged between 13 and 44 with a mean of 33.3 and a standard deviation of 8.6.

The overall performance on The Token Test for Children (DiSimoni, 1978) for the learning disabled group ranged between 40 and 57 with a mean of 50.4 and a standard deviation of 5.2. For the language impaired group, scores ranged between 35 and 57 with a mean of 47.8 and a standard deviation of 6.1.

The overall performance for the learning disabled group on the Processing Spoken Paragraphs Subtest of the Clinical Evaluation of Language Functions (CELF) (Semel & Wiig, 1980) ranged between 4 and 18 with a mean of 11.5 and a standard deviation of 6.4. Scores for the language impaired group ranged between 4 and 20 with a mean of 11.3 and a standard deviation of 4.9.

The overall performance on The Phonemic Synthesis Test (Katz & Harmon, 1981a) for the learning disabled group ranged between 5 and 18 with a mean of 9.5 and a standard deviation of 4.7. For the

language impaired group, scores ranged between 0 and 12 with a mean of 5.8 and a standard deviation of 3.5.

Analysis of Data

In order to test subhypotheses 1.1 through 1.6, the data were submitted to six two tailed t tests and the results are shown in Table 5.

The data revealed significant differences between the learning disabled and language impaired groups on the Auditory Sequential Memory Subtest of the ITPA (Kirk, McCarthy, & Kirk, 1968) (\underline{t} = 2.48, p = 0.02); the Auditory Attention Span for Unrelated Words of the DTLA (Baker & Leland, 1967) for both the Simple scores (\underline{t} = 3.00, p = .006) and Weighted score (\underline{t} = 3.18, p = .004); the Auditory Attention Span for Related Syllables of the DTLA (Baker & Leland, 1967) (\underline{t} = 4.31, p = .0001); and The Phonemic Synthesis Test (Katz & Harmon, 1981a) (\underline{t} = 2.37, p = .026). The learning disabled group scored significantly higher than the language impaired group on each of these tests. On the basis of these results, subhypothesis 1.1, 1.2, 1.3, and 1.6 were rejected.

Significant differences were not found between the learning disabled and language impaired groups on The Token Test for Children (DiSimoni, 1978) (\underline{t} = 1.24, p = .227) and the Processing Spoken Paragraphs Subtest of the CELF (Semel & Wiig, 1980) (\underline{t} = .10, p = .921). Although differences were slight, the learning disabled group scored higher than the language impaired group on both of these tests. Based on the results of this data, subhypotheses 1.4 and 1.5 were not rejected.

Table 5
A Comparison of Six Auditory Memory Tasks for the Learning Disabled
and Language Impaired Groups

Task	Learning Disabled Mean	<u>SD</u>	Language Impaired Mean	<u>SD</u>	<u>t</u> value	Two tail Probability
<u>ITPA</u>						
Auditory Sequential Memory	28.9	6.1	19.4	5.5	2.48	0.020
<u>DTLA</u>						
Auditory Attention Span for Unrelated Words Simple	40.9	5.2	34.9	5.8	3.00	0.006
Weighted	210.6	31.0	172.3	32.8	3.18	0.004
<u>DTLA</u>						
Auditory Attention Span for Related Syllables	49.5	11.17	33.3	8.6	4.31	0.0001
<u>Token Test for Children</u>	50.4	5.2	47.8	6.1	1.24	0.227
<u>CELF</u>						
Processing Spoken Paragraphs	11.5	6.4	11.3	4.9	.10	0.921
<u>Phonemic Synthesis</u>	9.5	4.7	5.8	3.5	2.37	0.026
<u>ITPA - Illinois Test of Psycholinguistic Abilities</u>						
<u>DTLA - Detroit Tests of Learning Aptitude</u>						
<u>CELF - Clinical Evaluation of Language Functions</u>						

To test subhypothesis 2.1, the relationship between performance on the Auditory Sequential Memory Subtest of the ITPA (Kirk, McCarthy, & Kirk, 1968), the Auditory Attention Span for Unrelated Words Subtest (Unrelated Words) of the DTLA (Baker & Leland, 1967), the Auditory Attention Span for Related Syllables (Related Syllables) of the DTLA (Baker & Leland, 1967), The Token Test for Children (DiSimoni, 1978), the Processing Spoken Paragraphs Subtest of the CELF (Semel & Wiig, 1980), and The Phonemic Synthesis Test (Katz & Harmon, 1981a) was analyzed for the learning disabled group using a Pearson product moment correlation (r) and results are presented in Table 6. The data revealed six positive correlations within the short-term memory battery which were significant at or below the .05 level of significance. A high degree of correlation was found between the Simple and Weighted scores of the Unrelated Words Subtest ($r = .99$, $p = .0001$, $r^2 = .96$). A marked degree of correlation was found between the following: the Simple score of the Unrelated Words Subtest and the Auditory Sequential Memory Subtest ($r = .68$, $p = .004$, $r^2 = .46$); the Weighted Score of the Unrelated Words Subtest and the Auditory Sequential Memory Subtest ($r = .65$, $p = .006$, $r^2 = .42$); and the Related Syllables Subtest and the simple score of the Unrelated Words Subtest ($r = .62$, $p = .009$, $r^2 = .38$). The data revealed a moderate degree of correlation between the Related Syllables Subtest and the Weighted score of the Unrelated Words Subtest ($r = .54$, $p = .023$, $r^2 = .29$) and between The Token Test for Children and the Related Syllables Subtest ($r = .55$, $p = .021$, $r^2 = .30$).

Table 6
Correlations Among Six Short-Term Memory Tasks for the
Learning Disabled Group

	<u>ITPA</u> Audi- tory Sequen- tial Memory	<u>DTLA</u> Unre- lated Words: Simple	<u>DTLA</u> Unre- lated Words: Weighted	<u>DTLA</u> Related Syllables	<u>Token Test</u> for Chil- dren	<u>CELF</u> Spoken Paragraphs
<u>ITPA</u> Audi- tory Sequen- tial Memory						
<u>DTLA</u> Unre- lated Words: Simple	$r = .68$ $p_2^2 = .004$ $r = .46$					
<u>DTLA</u> Unre- lated Words: Weighted	$r = .65$ $p_2^2 = .006$ $r = .42$	$r = .99$ $p_2^2 = .0001$ $r = .96$				
<u>DTLA</u> Related Syllables	$r = .41$ $p_2^2 = .074$ $r = .17$	$r = .62$ $p_2^2 = .009$ $r = .38$	$r = .54$ $p_2^2 = .023$ $r = .29$			
<u>Token Test</u> for Children	$r = -.02$ $p_2^2 = .470$ $r = -.05$	$r = .10$ $p_2^2 = .364$ $r = .003$	$r = .05$ $p_2^2 = .429$ $r = .003$	$r = .55$ $p_2^2 = .021$ $r = .30$		
<u>CELF</u> Spoken Paragraphs	$r = -.22$ $p_2^2 = .227$ $r = -.05$	$r = .07$ $p_2^2 = .406$ $r = .005$	$r = .02$ $p_2^2 = .478$ $r = .004$	$r = .34$ $p_2^2 = .119$ $r = .12$	$r = .28$ $p_2^2 = .167$ $r = .08$	
<u>Phonemic</u> <u>Synthesis</u>	$r = .08$ $p_2^2 = .393$ $r = .006$	$r = -.06$ $p_2^2 = .399$ $r = -.004$	$r = -.16$ $p_2^2 = .288$ $r = .03$	$r = .35$ $p_2^2 = .113$ $r = .12$	$r = .03$ $p_2^2 = .458$ $r = .0009$	$r = .02$ $p_2^2 = .467$ $r =$
.004						

ITPA - Illinois Test of Psycholinguistic Abilities
DTLA - Detroit Tests of Learning Aptitude
CELF - Clinical Evaluation of Language Functions

For these six correlations, the null hypothesis was rejected, but for the remaining 16 relationships, the null hypothesis was not rejected.

In testing subhypothesis 2.2, the relationship between performance on the Auditory Sequential Memory Subtest of the ITPA (Kirk, McCarthy, & Kirk, 1968), the Auditory Attention Span for Unrelated Words Subtest (Unrelated Words) of the DTLA (Baker & Leland, 1967), the Auditory Attention Span for Related Syllables (Related Syllables) of the DTLA (Baker & Leland, 1967), The Token Test for Children (DiSimoni, 1978), the Processing Spoken Paragraphs Subtest of the CELF (Semel & Wiig, 1980), and The Phonemic Synthesis Test (Katz & Harmon, 1981a) was analyzed for the language impaired group using a Pearson product moment correlation (r) and results are presented in Table 7. The data revealed nine positive correlations, significant at or below the .05 level of significance. A high degree of correlation was found between the Simple and Weighted scores of the Unrelated Words Subtest ($r = .98$, $p = .0001$, $r^2 = .96$), the Related Syllables Subtest and the Simple score of the Unrelated Words Subtest ($r = .85$, $p = .001$, $r^2 = .75$), and between the Related Syllables Subtest and the Weighted Score of the Unrelated Words Subtest ($r = .85$, $p = .0001$, $r^2 = .75$). The data revealed a marked degree of correlation between the following: the Weighted score of the Unrelated Words Subtest and the Processing Spoken Paragraphs Subtest ($r = .61$, $p = .011$, $r^2 = .37$); The Token Test for Children and the Simple score of the Unrelated Words Subtest ($r = .68$, $p = .003$, $r^2 = .45$); The Token Test for

Table 7
Correlations Among Six Short-Term Memory Tasks for the
Language Impaired Group

	<u>ITPA Audi-</u> <u>tory Sequen-</u> <u>tial Memory</u>	<u>DTLA Unre-</u> <u>lated Words:</u> <u>Simple</u>	<u>DTLA Unre-</u> <u>lated Words:</u> <u>Weighted</u>	<u>DTLA Related</u> <u>Syllables</u>	<u>Token Test</u> <u>for Chil-</u> <u>dren</u>	<u>CELF</u> <u>Spoken</u> <u>Paragraphs</u>
<u>ITPA Audi-</u> <u>tory Sequen-</u> <u>tial Memory</u>						
<u>DTLA Unre-</u> <u>lated Words:</u> <u>Simple</u>	$r = .30$ $P_2^2 = .52$ $r = .09$					
<u>DTLA Unre-</u> <u>lated Words:</u> <u>Weighted</u>	$r = .27$ $P_2^2 = .171$ $r = .07$	$r = .98$ $P_2^2 = .0001$ $r = .96$				
<u>DTLA Related</u> <u>Syllables</u>	$r = .37$ $P_2^2 = .095$ $r = .14$	$r = .85$ $P_2^2 = .001$ $r = .75$	$r = .85$ $P_2^2 = .0001$ $r = .75$			
<u>Token Test</u> <u>for Children</u>	$r = -.29$ $P_2^2 = .155$ $r = -.08$	$r = .68$ $P_2^2 = .003$ $r = .45$	$r = .69$ $P_2^2 = .003$ $r = .48$	$r = .57$ $P_2^2 = .017$ $r = .32$		
<u>CELF Spoken</u> <u>Paragraphs</u>	$r = -.35$ $P_2^2 = .109$ $r = -.12$	$r = .59$ $P_2^2 = .013$ $r = .35$	$r = .61$ $P_2^2 = .011$ $r = .37$	$r = .32$ $P_2^2 = .133$ $r = .10$	$r = .67$ $P_2^2 = .004$ $r = .45$	
<u>Phonemic</u> <u>Synthesis</u>	$r = .36$ $P_2^2 = .106$ $r = .13$	$r = .10$ $P_2^2 = .371$ $r = .01$	$r = -.10$ $P_2^2 = .369$ $r = .01$	$r = .02$ $P_2^2 = .447$ $r = .10$	$r = -.19$ $P_2^2 = .259$ $r = -.04$	$r = .01$ $P_2^2 = .487$ $r = .0001$

ITPA - Illinois Test of Psycholinguistic Abilities
DTLA - Detroit Tests of Learning Aptitude
CELF - Clinical Evaluation of Language Functions

Children and the Processing Spoken Paragraphs Subtest ($\underline{r} = .67$, $p = .004$, $\underline{r}^2 = .45$); The Token Test for Children and the Weighted score of the Unrelated Words Subtest ($\underline{r} = .69$, $p = .003$, $\underline{r}^2 = .48$). A moderate degree of correlation was found between the Simple score of the Unrelated Words Subtest and the Processing Spoken Paragraphs Subtest ($\underline{r} = .59$, $p = .013$, $\underline{r}^2 = .35$) and between The Token Test for Children and Related Syllables ($\underline{r} = .57$, $p = .017$, $\underline{r}^2 = .32$). For these nine correlations, the null hypothesis was rejected, but for the other 12 relationships which showed a negligible correlation, the null hypothesis was not rejected.

Chapter 5

SUMMARY, DISCUSSION, AND RECOMMENDATIONS

FOR FURTHER RESEARCH

Summary

The purposes of this study were: (a) to compare the short-term memory abilities of learning disabled and language impaired children as measured by the Auditory Sequential Memory Subtest of the Illinois Test of Psycholinguistic Abilities (Kirk, McCarthy, & Kirk, 1968), the Auditory Attention Span for Unrelated Words of the Detroit Tests of Learning Aptitude (Baker & Leland, 1967), the Auditory Attention Span for Related Syllables of the Detroit Tests of Learning Aptitude (Baker & Leland, 1967), The Token Test for Children (DiSimoni, 1978), the Processing Spoken Paragraphs Subtest of the Clinical Evaluation of Language Functions (Semel & Wiig, 1980), and The Phonemic Synthesis Test (Katz & Harmon, 1981a); and (b) to examine the relationship between performance on these six tasks for the two individual groups.

The subjects consisted of 28 children from the first, second, third, and fourth grades who were placed into two groups: a group of 14 learning disabled and a group of 14 language impaired children. All children were receiving resource services for either learning disability or language impairment and demonstrated adequate hearing and normal intelligence (IQ = 85 or above) as measured by

the SIT (Slosson, 1978). All language impaired children achieved a language quotient of 85 or below on the Test of Language Development (Newcomer & Hammill, 1977). Subjects were matched according to age (\pm six months), IQ (\pm ten points), and reading achievement (\pm six percentile points). The six tasks of the short-term memory battery were individually administered to all children within a three-week period. To avoid a possible order effect, presentation of the tasks was counter-balanced.

Results of six two tailed t tests revealed that the learning disabled scored significantly better on the Auditory Sequential Memory Subtest of the ITPA, the Auditory Attention Span for Unrelated Words of the DTLA, the Auditory Attention Span for Related Syllables of the DTLA, and The Phonemic Synthesis Test. No significant differences were found on The Token Test for Children, or the Processing Spoken Paragraphs Subtest of the CELF. Significant Pearson product moment correlations found among the tasks for the learning disabled group included: the Simple and Weighted scores of the Unrelated Words Subtest; the Unrelated Words and Auditory Sequential Memory Subtest; the Unrelated Words and Related Syllables Subtest; and The Token Test for Children and the Related Syllables Subtest. Significant correlations found among the tasks for the language impaired group included: the Simple and Weighted scores of the Unrelated Words Subtest; the Unrelated Words and Related Syllables Subtest; the Unrelated Words and the Spoken Paragraphs Subtest; the Unrelated Words Subtest and The Token Test for Children; and the Related Syllables Subtest and The Token Test for Children.

Discussion

The results of the data analysis revealed that of the six tasks presented, four differentiated the learning disabled and language impaired groups, with the language impaired group consistently scoring more poorly. It could be speculated from these data that language impaired children, as a group, are more likely to present auditory processing deficits when tested for short-term memory ability. It is interesting to note that the four tasks which showed significant differences all required a verbal imitated response to modeled stimuli while the remaining two tasks did not. It is possible that language impaired children had more difficulty when required to verbally repeat the stimuli presented. With the exception of the Related Syllables Subtest of the DTLA, each of these four tasks were devoid of meaning. When meaning was incorporated into the tasks, such as in The Token Test for Children and the Spoken Paragraphs Subtest of the CELF, both groups performed better (see Tables 8 and 9) suggesting that meaning facilitates the short-term memory abilities of these children.

Even though the learning disabled scored significantly better than the language impaired overall, many learning disabled children scored below age level on the six tasks. See Tables 8 and 9 for performance of the two groups. As a group, 29 percent of the learning disabled fell below age level on the Auditory Sequential Memory Subtest, as did 64 percent of the language impaired group.

Table 8
Performance on the Six Memory Tasks for the
Learning Disabled Group

Subject	<u>ITPA</u> Auditory Sequen- tial Memory	<u>DTLA</u> Unrelated Simple	<u>DTLA</u> Words Weighted	<u>DTLA</u> Related Sylla- bles	<u>Token</u> <u>Test for</u> <u>Children</u>	<u>CELF</u> Spoken Para- graphs	<u>Phone-</u> <u>mic</u> <u>Synthe-</u> <u>sis</u>
15	-	-	-	-	-	+	-
16	-	-	-	-	+	+	-
17	+	-	-	-	+	-	+
18	-	-	-	-	+	+	-
19	+	-	-	-	-	-	-
20	+	-	-	-	-	+	-
21	+	-	-	+	+	+	+
22	+	+	+	-	+	-	-
23	+	-	-	+	+	+	-
24	+	-	-	-	+	-	+
25	+	-	-	-	+	+	-
26	-	-	-	-	-	-	-
27	+	-	-	-	+	+	-
28	+	+	+	-	+	+	-
Below Age Level	29%	86%	86%	86%	29%	36%	79%

-Below Age Level

+ At or Above Age Level

Table 9
Performance on the Six Memory Tasks for the
Language Impaired Group

Subject	<u>ITPA</u> Auditory Sequen- tial Memory	<u>DTLA</u> Unrelated Words Simple	<u>DTLA</u> Words Weighted	<u>DTLA</u> Related Sylla- bles	<u>Token</u> <u>Test for</u> <u>Children</u>	<u>CELF</u> Spoken Para- graphs	<u>Phone-</u> <u>mic</u> <u>Synthe-</u> <u>sis</u>
1	+	+	+	-	+	+	-
2	+	-	-	-	-	-	-
3	-	-	-	-	-	-	-
4	+	-	-	-	+	+	-
5	-	-	-	-	-	-	-
6	-	-	-	-	-	+	-
7	-	-	-	-	+	+	-
8	-	-	-	-	+	+	-
9	-	-	-	-	-	+	-
10	-	-	-	-	+	+	-
11	-	-	-	-	-	+	-
12	+	-	-	-	+	-	-
13	+	-	-	-	-	+	-
14	-	-	-	-	+	-	-
Below Age Level	64%	93%	93%	100%	50%	36%	100%

- Below Age Level

+ At or Above Age Level

For the Unrelated Words Subtest, 86 percent of the learning disabled and 93 percent of the language impaired scored below age level. The Related Syllables Subtest showed that 86 percent of the learning disabled and 100 percent of the language impaired fell below age level. On The Token Test for Children, 29 percent of the learning disabled and 50 percent of the language impaired fell below age level. The Spoken Paragraphs Subtest showed 36 percent of both the learning disabled and language impaired scoring below age level. Finally, on The Phonemic Synthesis Test, 79 percent of the learning disabled and 100 percent of the language impaired fell below age level. These results indicated that as a group, 58 percent of the learning disabled children scored below age level on the entire short-term memory battery as did 74 percent of the language impaired. Therefore, although the learning disabled may have scored higher than the language impaired, short-term memory deficits were present within both groups.

Six positive correlations among tasks were present for the learning disabled group whereas nine were present for the language impaired group. The higher number of correlations within the language impaired group could be due to an overall reduction in scores on all tasks whereas there was more variability in the scores of the learning disabled group on the six tasks.

The results of the present study concerning the learning disabled group are in agreement with Fisher's (1982) speculation that at least half of this population present deficits in one or

more aspects of auditory processing. Results also agree with other authors (Ring, 1975; Wiig & Semel, 1980) who have indicated that memory deficits are apparent within the learning disabled population. In respect to the language impaired group, results are not in accord with Johnston (1982) who believes that auditory processing deficits are not a factor in these children's disability, however, the results support other authors speculations (Graham, 1968b; Menyuk & Looney, 1972) that deficient memory abilities may underlie language impairment. It is not possible to compare the present study to previous studies conducted because all were concerned with learning disabled and language impaired children in relation to normal children and not to each other.

The present results underscore the significance of short-term memory deficits within the learning disabled and language impaired populations. Speech and language pathologists and teachers of learning disabled students should assess memory abilities in every diagnostic procedure in order to better manage children in which deficits are apparent. Both professionals should work closely with classroom teachers to develop techniques such as chunking (placing pauses in utterances to aid retention), over emphasis and repetition of key words to insure that students with short-term memory deficits cue in to important details.

Results of a related study on the language abilities of these learning disabled and language impaired children (Moore, 1983), as measured by the Clinical Evaluation of Language Functions (Semel &

Wiig, 1980), revealed that the learning disabled scored significantly better on Producing Model Sentences and syntax. No significant differences were found on any other individual subtest, overall processing scores, overall production scores, semantics, or memory. The language impaired scored better, though not significantly, on only two subtests: Producing Word Series and Confrontation Naming. In relation to the present study, the significantly higher score of the learning disabled group on the Producing Model Sentences Subtest may be explained by their overall increased ability to retain information in short-term memory in comparison to the language impaired group.

These same students were also subjects of a study concerning reading ability (Scarboro, 1983) which revealed a significant difference between the learning disabled and language impaired children on one category of the Reading Miscue Inventory (Burke & Goodman, 1972). Language impaired children scored significantly better than learning disabled children when errors of reading involved no meaning change within the passage. There were no significant differences between the two groups on 32 other categories of analysis. On 18 categories, the learning disabled exhibited more errors, while the language impaired exhibited more errors on 13 of the categories. The significance involving errors of no meaning change in which the language impaired group scored higher may be explained in part in that meaning appears to aid in the retention of information for this group.

Recommendations for Further Research

The following suggestions are made for future research as a result of the present study:

1. This study should be replicated on a larger sample of subjects including a normal group, to corroborate the present findings.
2. The learning disabled group should be selected according to specific disabilities (i.e., mathematics, reading) to insure a more homogeneous group.
3. The language impaired group should be selected according to specific language deficits (i.e., semantics, syntax) to insure a more homogeneous group.
4. Other measures of auditory short-term memory should be employed to elaborate upon present findings.
5. The assessment of long-term memory should be included to find significant differences within the two groups.
6. The effect of various control processes such as rehearsal, coding and imaging should be studied as they influence short-term memory ability in the learning disabled and language impaired.

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APPENDIX A

Formula for Placement in the Learning

Disabilities Program

Appendix A

Formula for Placement in the Learning Disabilities Program

The following procedure is used in calculating an expected grade-level functioning based upon the results of an intelligence test:

- a. Obtain the intelligence test score (IQ).
- b. Obtain the student's chronological age (CA).
- c. Convert the CA to months (i.e. 8-9 = 105 months).
- d. Convert 5.5 to 66 months (5.5 = 5½ years).
- e. Substitute that information in the following formula:

$$\frac{\text{IQ}}{100} \times (\text{C.A.} - 5.5) = \text{Expected Grade Achievement}$$

- f. Example: If the obtained IQ is 110 and the student's CA is 12-0:

$$\frac{110}{100} \times (144-66) = \text{Expected Grade Achievement}$$

$$\frac{110}{100} \times (78) = \text{Expected Grade Achievement}$$

$$1.1 \times 78 = \text{Expected Grade Achievement}$$

$$85.8 \text{ months} = \text{Expected Grade Achievement}$$

$$85.8 \text{ divided by } 12 = 7 \text{ years } 1.8 \text{ months}$$

$$7-2 = \text{Expected Grade Achievement}$$

Determine the amount of discrepancy from the expected academic performance and current academic performance.

APPENDIX A

(continued)

- a. Obtain current achievement test scores in any of the achievement areas under consideration.
- b. Subtract the Expected Grade Achievement Score from the Current Grade Achievement Score.
- c. Compare that difference score to the Degree of Severity Index.
- d. Define the pupil's achievement level as falling within the Mild, Moderate, or Severe level of discrepancy.

APPENDIX B

Notification to Parents

Appendix B
Notification to Parents

April 6, 1983

Dear _____,

We are currently conducting a comparative study of Language Impaired and Learning Disabled children enrolled in the Davidson County School System. With your permission, we would like for your child, _____, to participate in this study.

Your child and others selected will be evaluated in language, short-term memory and reading by our Speech/Language therapists.

The results will enable us to:

- better understand the relationship between language and learning disabilities
- develop a more effective individualized educational plan (IEP) for your child
- plan more effective ways to utilize Speech/Language and LD personnel

Please indicate your willingness for your child to participate in this study by completing the attached form and returning it to me in the enclosed envelope by Friday, April 15, 1983. Call me if you have questions concerning this matter.

Thank you for your cooperation.

Cordially,

Kenneth C. Drum
Director of Programs for
Exceptional Children

APPENDIX C

Permission for Participation

Appendix C

Permission for Participation

To: Ken Drum
Director of Programs for
Exceptional Children

You have my permission to include my child, _____, in the study regarding Language and Learning Disabled children. I understand that I can call Ken Drum at (704) 249-8182 for additional information and that I can receive results of the testing and study by making a written request.

Signed _____

Date _____

APPENDIX D

Auditory Sequential Memory Subtest

Appendix D

Auditory Sequential Memory Subtest of the Illinois
Test of Psycholinguistic Abilities

(Kirk, McCarthy, & Kirk, 1968)

- | | | | | | |
|-----|-----------|-------|-----|-----------------|-------|
| 1. | 9-1 | _____ | 19. | 6-9-5-7-2-8 | _____ |
| 2. | 7-9 | _____ | 20. | 3-6-1-9-2-7-7 | _____ |
| 3. | 8-1-1 | _____ | 21. | 5-3-6-9-7-8-2 | _____ |
| 4. | 6-4-9 | _____ | 22. | 8-1-6-2-5-9-3 | _____ |
| 5. | 5-2-8 | _____ | 23. | 2-7-4-1-8-3-6 | _____ |
| 6. | 2-7-3-3 | _____ | 24. | 4-9-6-3-5-7-1 | _____ |
| 7. | 6-3-5-1 | _____ | 25. | 3-1-9-2-7-4-8-8 | _____ |
| 8. | 8-2-9-3 | _____ | 26. | 9-6-3-8-5-1-7-2 | _____ |
| 9. | 1-6-8-5 | _____ | 27. | 4-7-3-1-6-2-9-5 | _____ |
| 10. | 4-7-3-9-9 | _____ | 28. | 8-2-59-3-6-4-1 | _____ |
| 11. | 6-1-4-2-8 | _____ | | | |
| 12. | 1-5-2-9-6 | _____ | | | |
| 13. | 7-3-1-8-4 | _____ | | | |
| 14. | 5-9-6-2-7 | _____ | | | |

APPENDIX E

Auditory Attention Span for Unrelated Words of the

Detroit Tests of Learning Aptitude

(Baker & Leland, 1967)

Appendix E

Auditory Attention Span for Unrelated Words of the

Detroit Tests of Learning Aptitude

(Baker & Leland, 1967)

2a cat ice

2b dog ship

3a man horse song

3b pen girl cow

4a cart bird desk road

4b chair hen book vest

5a head milk dress oats night

5b pipe west fence coat mule

6a fish clock heart sun box frog

6b stone blot freeze door cut white

7a skirt plant friends east tub barn hair

7b mud vase north ten rain cross shoe

8a ear boat key pig south knob ink rope

8b flour skate fan spend lamp wool axe toad

APPENDIX F

Auditory Attention Span for Related Syllables of the

Detroit Tests of Learning Aptitude

(Baker & Leland, 1967)

Appendix F

Auditory Attention Span for Related Syllables of the
Detroit Tests of Learning Aptitude

(Baker & Leland, 1967)

1. My doll has pretty hair.
2. We will go for a walk.
3. My dog chases the white cat.
4. Our new car has four red wheels.
5. Henry likes to read his new book.
6. Bring the broom and sweep the front room.
7. The bell on the engine rings loudly.
8. On Sundays all of us go to church.
9. In summer we go North where it is cool.
10. Green leaves come on the trees in early spring.
11. The airplane makes a loud noise when it flies fast.
12. We saw a little fire on the way to school.
13. The sun shone brightly today and it hurt my eyes.
14. The men painted our new house white with dark green blinds.
15. They gave me some pretty shoes for my birthday last month.
16. The art teacher comes to our own school three days a week.
17. Ten persons went to a party where there was lots to eat.
18. Three boys spent a happy day last week on a fishing trip.
19. On Tuesday for lunch we had some fresh bread which our mother baked.

20. Father must buy some new license plates for his car once each year.
21. When the train passes the whistle blows for us to keep off the track.
22. In the summer time the nights are very short and the days are long.
23. We had a party for Jean last Monday with cake and ice cream to eat.
24. At eight we go to bed and mother reads to us from our story books.
25. Each year when the big circus comes to town father takes the whole family.
26. Many boys and girls go to the movies on nights at the end of each week.
27. My sister Mary has a pretty new doll which shuts its eyes and goes to sleep.
28. The man who lives next door is a good neighbor and invites us for many rides.
29. Last winter we made a big round snow man and put a little black hat on his head.
30. In my uncle's home there was a soft red carpet on the floor of the living room.
31. The day of the football game the weather was clear but chilly and the wind blew briskly.
32. Because there were few vacant lots the police roped off our street so that we might be safe.
33. On the Fourth of July my father puts on his army suit and joins his friends on parade.
34. In fair weather and at high tide ships from many nations set sail for their own distant ports.
35. The baseball team from our high school played fifteen games; they lost six but they ended in second place.
36. Last night there was a large banquet at the hotel where many people dined and had a pleasant time.

37. Our reading books at school have many fine stories which are short but very full of life and action.
38. In the north country the days are very short in winter and the sun hangs low in the southern sky.
39. China closets filled with all kinds of dainty dishes and cut glass lined the large walls of the dining room.
40. On cold, clear nights hundreds of thousands of twinkling stars shine brightly from their cradles far up in the sky.
41. In the heart of the Congo there are many kinds of beasts which are a nightly terror to the black natives.
42. Down near the bank of the river is an estate from which sound the shouts of happy children hour after hour.
43. Each four years voting takes place which results in many men being placed in office for terms of two years or more.

APPENDIX G

The Token Test for Children (DiSimoni, 1978)

Appendix G

The Token Test for Children

(DiSimoni, 1978)

	TEST COMMANDS	Score
Part I	Use Arrangement A (Large Tokens)	
1.	Touch the red circle	_____
2.	Touch the green square.	_____
3.	Touch the red square.	_____
4.	Touch the yellow circle.	_____
5.	Touch the blue circle.	_____
6.	Touch the green circle.	_____
7.	Touch the yellow square.	_____
8.	Touch the white circle.	_____
9.	Touch the blue square.	_____
10.	Touch the white square.	_____
Part II	Use Arrangement B (All Tokens)	
1.	Touch the small yellow circle.	_____
2.	Touch the large green circle.	_____
3.	Touch the large yellow circle.	_____
4.	Touch the large blue square.	_____
5.	Touch the small green circle.	_____
6.	Touch the large red circle.	_____
7.	Touch the large white square.	_____

8. Touch the small blue circle. _____
9. Touch the small green square. _____
10. Touch the large blue circle. _____

Part III. Use Arrangement A (Large Tokens)

1. Touch the yellow circle and the red square. _____
2. Touch the green square and the blue circle. _____
3. Touch the blue square and the yellow square. _____
4. Touch the white square and the red square. _____
5. Touch the white circle and the blue circle. _____
6. Touch the blue square and the white square. _____
7. Touch the blue square and the white circle. _____
8. Touch the green square and the blue circle. _____
9. Touch the red circle and the yellow square. _____
10. Touch the red square and the white circle. _____

Part IV. Use Arrangement B (All Tokens)

1. Touch the small yellow circle and the large green square. _____
2. Touch the small blue square and the small green circle. _____
3. Touch the large white square and the large red circle. _____
4. Touch the large blue square and the large red square. _____
5. Touch the small blue square and the small yellow circle. _____

6. Touch the small blue circle and the small red circle. _____
7. Touch the large blue square and the large green square. _____
8. Touch the large blue circle and the large green circle. _____
9. Touch the small red square and the small yellow circle. _____
10. Touch the small white square and the large red square. _____

APPENDIX H

The Token Test for Children (DiSimoni, 1978)

Appendix H

The Token Test for Children

(DiSimoni, 1978)

Part V

Part V Use Arrangement A (Large Tokens)

1. Put the red circle on the green square. _____
2. Put the white square behind the yellow circle. _____
3. Touch the blue circle with the red square. _____
4. Touch -- with the blue circle -- the red square. _____
5. Touch the blue circle and the red square. _____
6. Pick up the blue circle or the red square. _____
7. Put the green square away from the yellow square. _____
8. Put the white circle in front of the blue square. _____
9. If there is a black circle, pick up the red square. _____
10. Pick up the squares, except the yellow one. _____
11. When I touch the green circle, you take the
white square. _____
12. Put the green square beside the red circle. _____
13. Touch the square slowly and the circles, quickly. _____
14. Put the red circle between the yellow square
and the green square. _____
15. Except for the green one, touch the circles. _____

16. Pick up the red circle -- No! -- the white square. _____
17. Instead of the white square, take the yellow
circle _____
18. Together with the yellow circle, take the blue
circle. _____
19. After picking up the green square, touch the
the white circle. _____
20. Put the blue circle underneath the white square. _____
21. Before touching the yellow circle, pick up the
red square. _____

APPENDIX I

Processing Spoken Paragraphs Subtest of the
Clinical Evaluation of Language Functions

(Semel & Wiig, 1980)

Appendix I

Processing Spoken Paragraphs Subtest of the
Clinical Evaluation of Language Functions

(Semel & Wiig, 1980)

Trial Items

For her birthday Lisa's grandmother gave her an old gold locket. The locket had Lisa's name on the cover. The locket was a little scratched but it still sparkled beautifully.

1. What did Lisa get for her birthday?
2. Who gave the locket to Lisa?
3. What was on the cover?

Record the child's response verbatim in the space next to each question.

PARAGRAPH 1

Jack got a new cat for his birthday. The cat was brown and white. It was a present from his grandmother.

1. What did Jack get for his birthday?
2. What color was the cat?
3. Who gave the cat to Jack?

Appendix I

(continued)

PARAGRAPH 2

The newest delight in candy comes to you from the Jim Dandy Candy Company. This great taste sensation is called Chocolate Crickets. There are ten Chocolate Crickets to a box which costs one dollar.

1. What is the name of the candy?
2. Who makes the candy?
3. What does a box cost?

PARAGRAPH 3

The Frontier Color Puzzle may be just what you want for your next birthday. The puzzle, which is made of 100 percent recycled paper, is sold at all ABC drugstores. Everyone on your block will want this exciting toy which costs only three dollars and fifty cents.

1. What is the name of the toy?
2. Where can you buy it?
3. What is it made of?
4. What does it cost?

Appendix I

(continued)

PARAGRAPH 4

April 1 was cloudy over most of the Eastern mountain ranges with rain through the Western lake region. Temperatures ranged with 17 degrees in the North 28 degrees in the South. Tonight the skies will be clearing and tomorrow will be warm and sunny with temperatures in the twenties.

1. What was the date of the weather report?
2. What was the weather like in the Eastern mountain ranges?
3. Where did it rain?
4. Where was the temperature 17 degrees?
5. What was the temperature in the South?
6. When will it be warm and sunny?
7. What will the temperatures be on April 2?

TOTAL RAW SCORE

APPENDIX J

The Phonemic Synthesis Test (Katz & Harmon, 1981a)

Appendix J

The Phonemic Synthesis Test

(Katz & Harmon, 1981a)

Name _____ Age _____ Grade _____ Date _____

- | | | | | | |
|-----|------|-------|-----|-------|-------|
| 1. | each | _____ | 14. | gift | _____ |
| 2. | shoe | _____ | 15. | dress | _____ |
| 3. | boat | _____ | 16. | sky | _____ |
| 4. | bake | _____ | 17. | child | _____ |
| 5. | dog | _____ | 18. | cold | _____ |
| 6. | buy | _____ | 19. | ghost | _____ |
| 7. | coat | _____ | 20. | spoon | _____ |
| 8. | make | _____ | 21. | paper | _____ |
| 9. | cow | _____ | 22. | bank | _____ |
| 10. | dish | _____ | 23. | stone | _____ |
| 11. | say | _____ | 24. | train | _____ |
| 12. | see | _____ | 25. | milk | _____ |
| 13. | pie | _____ | | | |

25-() # errors = _____ Score (# correct) %-ile _____

APPENDIX K

Scoring of The Phonemic Synthesis Test (Katz & Harmon, 1981a)

Appendix K

Scoring of The Phonemic Synthesis Test

(Katz & Harmon, 1981a)

Correct response: check placed in blank.

Linguistic substitution: word written in blank.

Non-linguistic substitution: phonetic transcription.

Sound-by-sound (not synthesized): phonemes written separately.

Omission: slash placed in blank.

VITA

Betsy Barber Shoaf was born in Salisbury, North Carolina on August 12, 1957 to Mr. and Mrs. Eugene Demasure Barber, Jr. She attended Churchland Elementary School in Lexington, North Carolina and graduated from West Davidson High School in 1975. She entered Appalachian State University and received a Bachelor of Science degree in the field of Speech Pathology and audiology in December 1979. Since that time she has worked as a Speech and Language Pathologist in the Davidson County School System and attended Appalachian State University on a part-time basis. In December 1983, she completed the requirements for a Master of Arts degree in Speech Pathology and Audiology.

Mrs. Shoaf is married to Barry C. Shoaf of Lexington and they currently reside in Tyro, North Carolina.