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MEASURING COGNITIVE SKILLS OF LANGUAGE IMPAIRED PRESCHOOLERS WITH THE KAUFMAN ASSESSMENT BATTERY FOR CHILDREN

by

Philip William Richard Ricciardi
M.A., University of Windsor, 1983

A Dissertation submitted to the Faculty of Graduate Studies and Research through the Department of Psychology in Partial Fulfillment of the requirements for the Degree of Doctor of Philosophy at the University of Windsor

Windsor, Ontario, Canada 1987
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Measuring Cognitive Skills of Language Impaired Preschoolers with the Kaufman Assessment Battery for Children

ABSTRACT

This study examined the effects of language impairments on a child's level and pattern of performance on the Kaufman Assessment Battery for Children (K-ABC). Three groups of exceptional children were compared: 14 children with a language impairment and no behavioral difficulties, 13 children with language impairment and behavior problems, and 17 children with behavior problems and no language impairment. A Comparison group of 15 children without behavior and/or language problems was also included. Groups were compared on pattern of performance on the K-ABC Mental Processing and Achievement Scales, and on level of performance on the K-ABC in contrast to the McCarthy Scales of Children's Abilities (MSCA).

While children were differentiated on the basis of the presence or absence of either a language impairment or behavior problems, the findings lacked the specificity necessary for classification purposes on the basis of pattern of performance. The lack of a distinctive K-ABC profile for children with a language impairment contradicted predictions based upon theoretical models underlying the K-ABC. Interestingly, those children with only behavior problems exhibited the pattern expected for language impaired children, a higher Simultaneous Processing score in comparison to both the Sequential Processing and Achievement Scales. In addition, children with a language impairment
exhibited a significantly higher overall performance on the K-ABC than on the MSCA, lending support to the contention that the K-ABC may facilitate the assessment of exceptional preschoolers.

Several explanations were presented to account for the lack of a distinctive pattern on the K-ABC for language impaired children. It was suggested the performance of children with a language impairment may have been indicative of an inability to effectively utilize the two processing strategies, a delay in the emergence of these cognitive processes, or more global development delays. The results also indicated that the test performance of children with only behavior problems was affected by such factors as distractibility and attentional difficulties.
ACKNOWLEDGEMENTS

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Measuring Cognitive Skills of Language Impaired Preschoolers with the Kaufman Assessment Battery for Children

INTRODUCTION

The past two decades have witnessed an increase in the provision of educational and habilitative services to the preschool child (Lidz, 1983). The impetus for such interest has emerged from a variety of sources. For example, legislation has been introduced in the Canadian Provinces (e.g., Bill 82 - The Education Act, 1980: A Provision of Special Education Services) aimed at ensuring that children receive educational programs that are tailored to their particular needs. Concurrently, there has been an increase in the number of young children attending various daycare and preschool centres, which has led to increased focus on the need for more effective programming. The success of such programmes as Head Start in the United States has reinforced the notion that preschoolers may benefit from intervention in the early stages of their development (Lazar & Darlington, 1982; Abbott & Crane, 1977; Nazzaro, 1974).

Effective early intervention is very dependent on reliable, valid identification of children that will potentially benefit from special programming. The two most prevalent developmental problems presented by preschoolers "at risk" for poor academic adjustment are language dysfunction and behavioral control deficits (Stevenson, Richman, & Graham, 1985). Many preschool children identified as language impaired also show evidence of behavioral...
maladjustment (Baker & Cantwell, 1983). Differentiation of linguistic and behavioral problems is crucial for effective programming, yet little is known about the relative impact of these two risk factors on intelligence testing, which is typically the major method used for identification of children suspect to have developmental deficits (Reynolds & Clark, 1983; Sattler, 1982). The goal of the present study is to investigate the effects of language and behavior dysfunction on cognitive skill testing.

Despite the acknowledged importance of the preschool years for development of crucial cognitive, social, and behavior control skills (Bryen & Gallagher, 1983; Schroeder, Gordon, & Hawk, 1983); and the existence of legislation to assist in the acquisition of services for preschoolers, this population is relatively under-represented in assessment literature, and very little is known about the effect of developmental problems on assessment results. The present study will examine the utility of a relatively new test of cognitive skills, the Kaufman Assessment Battery for Children (Kaufman & Kaufman, 1983a) for assessing children with language and/or behavior disorders.

By virtue of their rapid rate of development and the behavioral characteristics associated with their immaturity, preschool children present some unique challenges for assessment. In the discussion below, issues relevant to assessing preschoolers will be reviewed, and intelligence tests available for this population will be described and
critiqued in terms of utility for assessing normally developing preschool children and those "at risk" for academic adjustment problems.

**Assessment of preschool children**

**Labelling.** The major aim of preschool assessment is to identify those children who are currently experiencing difficulties which place them "at risk" developmentally. This purpose has associated with it a number of common and unique factors which are particularly pertinent to the assessment of young children (e.g., labelling, stability of IQ, and characteristics of preschoolers). Whether or not assessment is warranted is of central importance and represents the first phase in any diagnostic procedure, that of "problem clarification" (Sloves, Docherty, & Schneider, 1979). This step is extremely important when it pertains to the young child, given the possible negative effects that mislabelling a child or even labelling per se may have (Hobbs, 1979; Fallen & McGovern, 1978; Mercer, Algozzine, & Trifiletti, 1979). Some critics of preschool assessment have argued that labelling may produce a self fulfilling prophecy or that the label may become the handicap (Cohen et al., 1979).

**Stability of IQ.** Contributing to the concerns arising from labelling, is the question of the stability of IQ in children. In their longitudinal studies, McCall and his colleagues (McCall, Hogarty, & Hurlburt, 1972; McCall, Appelbaum, & Hogarty, 1973; McCall, 1979) found that a
child's IQ varied an average of 28.5 points between the ages of two and a half and 17 years. The same authors, though, also indicate that children with low IQs are likely to display lower amounts of change than children with high IQs. This finding implies that children identified as being "at risk" (i.e., those with low IQ scores) are likely to continue to experience difficulties as they mature.

In examining some of the factors which may influence the accuracy of prediction, Keogh and Becker (1973) have called attention to a methodological paradox. Briefly, the authors state that if early identification led to successful remediation of learning problems, the preschooler initially identified as at "high risk" would be a normal achiever. Therefore, the predictive validity of the identification instrument would be low. Lidz (1983) reinforces the notion of this paradox when she states that early interventionists never avoid the dilemma involved in selecting a child for special services. Except in those instances of extreme disorder, in which the prognosis is known, the examiner cannot be certain that the child would have developed difficulties if intervention had not occurred.

In a series of studies of young mentally retarded children, Kirk (1972) found that children given preschool training gained substantially in their performance on intellectual measures while the performance of children who did not participate in preschool training declined. Other authors have also demonstrated that intellectually
handicapped children have benefited from early intervention programs that have resulted from preschool assessment (e.g., Hayden, 1978; Jordan, Hayden, Karnes & Wood, 1979; Garber & Heber, 1982).

Characteristics of preschool children. Of particular importance, and relevance to the present study, are those characteristics which distinguish preschoolers from other children. Preschoolers can be extremely difficult to assess. Many of those children identified as requiring assessment possess characteristics that can complicate the assessment process (Meier, 1973; Lidz, 1983). These children often do not possess adequate receptive or expressive language abilities, their attention span is limited, they are struggling with the issue of separation, and they may not be particularly concerned with being compliant and cooperative.

Few studies have directly examined the relationship between general development, language abilities, and behavioral difficulties. In an epidemiological study, Stevenson and Richman (1978) reported that behavior problems were present in 14% of a random sample of 705 three year old children. Furthermore, it was demonstrated that behavior problems and language delays were significantly related in this sample (i.e., over 50% of the children with language delays displayed behavior problems). This pattern was confirmed in a study conducted by Jenkins, Bax, and Hart (1980) in which 35% of preschool children with language
difficulties were found to be experiencing behavior problems. In a series of studies, Cantwell and his colleagues (Cantwell & Baker, 1980; Cantwell, Baker, & Mattison, 1980; Baker & Cantwell, 1983) examined the prevalence of behavior disorders and other psychiatric difficulties in groups of preschool and school age children with speech and language problems. The results of an early preliminary study (Cantwell & Baker, 1980) indicated that over half of the children examined exhibited some form of symptomatology (e.g., temper tantrums, destructiveness, and inappropriate affect). In a subsequent study, Baker and Cantwell (1983) noted that 53% of their speech or language impaired sample demonstrated some type of psychiatric disorder (e.g., conduct disorder). It was also reported that the behavioral, emotional, and developmental problems evident in these children could not be attributed solely to adverse environmental and/or social factors (Baker & Cantwell, 1983). The authors concluded that children with communication disorders are clearly "at risk" for conduct disorders, behavior disorders, and emotional disorders (Cantwell & Baker, 1980).

Several more recent studies have confirmed the significant relationship between language delays and behavior problems. In a study involving three year olds, it was reported that 22% of those children with language difficulties also displayed some evidence of behavior
problems (Stevenson, Richman, & Graham, 1985). Similarly, it has been demonstrated that the prevalence of behavioral and/or emotional problems in a sample of five-year old children with speech and/or language impairments approached 50% (Beitchman, Nair, Clegg, Ferguson, & Patel, 1986). It has also been suggested that the relationship between language problems and behavioral difficulties may be indicative of more general delays in the child's development (Stevenson et al., 1985). Clearly, language delays and behavior problems constitute important variables in the assessment of preschool children suspected to be "at risk" developmentally. Consequently, it is important to determine the way in which these variables influence a child's performance on measures of development.

Goals of assessment

The discussion thus far has raised a number of critical issues that may compromise the evaluation of young children; however, there is important justification for pursuing the testing of preschoolers. Early assessment provides the opportunity for detecting problems before they reach a magnitude at which intervention and remediation are no longer effective (Reynolds & Clark, 1983). According to Keogh and Becker (1973), the only justification for an assessment is to anticipate and remediate problems as soon as possible.

Lidz (1983) recommends, given some of the issues raised, that the focus of assessment and attempts at
remediation should be upon the child's current deficits rather than on future problems predicted on the basis of current deficits. For example, visual-perceptual difficulties in a preschool child are generally predictive of reading problems at some later time. However, the emphasis of treatment should be upon the remediation of the child's current visual-perceptual difficulties, and the assessment and remediation of his/her reading skill should occur at a later point. The intellectual assessment of preschool age children should have as its goals then: (a) identification of children "at risk" and in need of special services, (b) determination of the child's specific difficulties, and (c) development of appropriate programming which utilizes the child's abilities and remediates present deficits (Reynolds, 1979; Lidz, 1983).

Preschool measures of intelligence

Once the decision has been made to conduct a formal intellectual assessment, the examiner must select the most appropriate instrument. Generally, an individual intelligence test is utilized as the primary implement in the diagnosis of cognitive disorders (Reynolds & Clark, 1983). The number of major preschool intelligence tests has been limited, for the most part, to three measures: the Stanford-Binet Intelligence Scale, the Wechsler Preschool and Primary Scale of Intelligence (WPPSI) (Wechsler, 1967), and the McCarthy Scales of Children's Abilities (MSCA) (McCarthy, 1972).
Stanford-Binet Intelligence Scale. The Stanford-Binet Intelligence Scale originated in 1905 from the work of Alfred Binet and has since undergone six revisions (i.e., 1916, 1937, 1960, 1968, 1972, 1986). The most recent revision represents a significant departure from previous editions. Form L-M of the Stanford-Binet (i.e., 1972 revision) provides information about the kinds of things a child can do rather than what they cannot do. This information is helpful in planning recommendations for the child based upon his/her strengths rather than weaknesses.

While the Stanford-Binet has been widely used, it is not without critics who have argued that the obtained IQ score is only a global measure of the child's functioning. This score does not permit a breakdown into verbal and performance factors or other specific abilities. An analysis of the content of the test items, as classified by Lutey (1981), reveals some variability in terms of the skills or abilities assessed at each age level. It is apparent, for example, that there is a shift from tasks requiring visual-motor coordination at the younger age levels to items requiring verbal abilities at the older age levels. The disparity between items occurs not only between the different age levels but within the same age level as well. This can result in equivalent scores on tasks requiring different levels of ability thereby making interpretation and classification more difficult (Davis & Rowland, 1974). It has been demonstrated, for example, that
retarded groups tended to excel over nonretarded groups (matched on the basis of mental age) on tasks involving manipulation, perceptual discrimination and to a lesser degree, verbal comprehension (Achenbach, 1970; 1971). In addition, the reliability of the individual subtests is generally unknown, but suspected to be low, thereby contributing to the difficulty in the interpretation of test results (Reynolds & Clark, 1983).

Apart from the issues concerning the variability of item content, the Stanford-Binet has also been criticized for the lack of information regarding the 1972 standardization sample. The paucity of such information has made it difficult to determine if the sample was actually representative of the 1972 school age population (Waddell, 1980; Davis & Rowland, 1974). Some caution may therefore be warranted in terms of classification and interpretation based upon the Stanford-Binet test results. For example, Bloom, Raskin, and Reese (1976) reported that for 27 of 50 developmentally delayed children, the Wechsler Intelligence Scale for Children-Revised (Wechsler, 1974) and Stanford-Binet IQs did not fall in the same classification category (e.g., mild mental retardation, etc.).

Some of the noted shortcomings have been addressed by the Fourth Edition developed by Thorndike, Hagen, and Sattler (1986). The authors have revised the Stanford-Binet to serve a number of purposes including differential diagnosis (e.g., learning disabilities versus mental
retardation) of preschool children. Given its recent development, reliability and validity studies have yet to be reported in the literature. Consequently, its usefulness in assessing preschoolers is difficult to ascertain.

Wechsler Preschool and Primary Scale of Intelligence. The WPPSI represents one alternative to the Stanford-Binet and was developed by Wechsler (1967) for children between four and six and a half years of age. It is generally perceived as a downward extension of the Wechsler Intelligence Scale for Children-Revised (Wechsler, 1974). The WPPSI consists of 11 subtests which are utilized in determining the child's Full Scale IQ as well as a Verbal IQ and Performance IQ. The WPPSI possesses several advantages over the Binet in terms of its evaluation of a variety of cognitive skills and the number of interpretive schemes available to the examiner (Lutey, 1981; Sattler, 1982; Reynolds & Clark, 1983). However, a number of limitations of the WPPSI have been cited. For example, the administration time has been considered unnecessarily long and boring for preschoolers, making it difficult to keep a young child motivated (McLoughlin, 1983; Reynolds & Clark, 1983). Sattler (1982) has indicated that the WPPSI is limited by having an inadequate floor (i.e., it does not clearly differentiate abilities at the lower end of the scale) and a limited ceiling (i.e., it does not differentiate abilities at the higher end of the scale). The intensive amount of professional training required to
learn the proper administration, scoring, and interpretation of the test has also been listed as a drawback of the WPPSI (Reynolds & Clark, 1983).

**McCarthy Scales of Children's Abilities.** The MSCA were developed for use with children ages two and a half to eight and a half years of age. This test offers an alternative to the WPPSI and Stanford-Binet, both of which may be somewhat limited in their usefulness for preschool children (Nagle, 1979; Gerken, Hancock, & Wade, 1978; Davis & Rowland, 1974). Kaufman and Kaufman (1977a; 1977b) state that the McCarthy Scales not only challenge the Wechsler/Binet monopoly on preschool intelligence testing, but also meet the needs of clinicians engaged in the psychoeducational diagnosis of learning problems.

The MSCA consist of 18 subtests grouped into different scales: Verbal, Perceptual-Performance, Quantitative, Memory, Motor, and General Cognitive. The first three scales account for the majority of subtests (i.e., 15 of 18 subtests) and are summed to determine the General Cognitive Scale (i.e., General Cognitive Index score - GCI). The MSCA are at least as reliable and stable as other preschool intelligence tests (Kaufman & Kaufman, 1977a; Nagle, 1979). Unlike the WPPSI tasks, the MSCA subtests have sufficient floor and ceiling levels for most preschool and kindergarten children. Sattler (1982) has noted that the MSCA have a greater potential for providing information, especially with exceptional children, than either the WPPSI.
or Stanford-Binet.

The MSCA would appear to provide a comparable measure of intellectual functioning to conventional IQ tests (e.g., WPPSI, WISC-R, and Stanford-Binet) in normal preschool and kindergarten children (Kaufman, 1973; Davis, 1975; Harrison & Wiebe, 1977; Nagle, 1979; Krohn & Traxler, 1979). A number of researchers (e.g., Goh & Youngquist, 1979; Levenson & Zeno, 1979; Gerken et al., 1978) have expressed concern regarding the MSCA’s ability to identify children experiencing learning disabilities or mental retardation. However, the discrepancies between the MSCA GCI and conventional IQ, as noted by these authors, have been primarily attributed to the lack of stringent controls (Bracken, 1981). Naglieri (1980) demonstrated, for example, that a reported GCI-IQ discrepancy was a function of the difference between the standard deviations of the MSCA and WISC-R. Other researchers (e.g., Sturner, Funk, & Green, 1984; Massoth, 1985) have indicated that the MSCA are capable of identifying children "at risk" for academic difficulties and are able to predict kindergarten children's performance over a five year period. Consequently, the MSCA may be utilized in place of the Wechsler Scales and Stanford-Binet in assessment of preschool and kindergarten aged children.

While the McCarthy Scales appear to have many advantages, some limitations are evident. For example, the administration of the full McCarthy is somewhat lengthy,
usually requiring an hour to an hour and a half for each child. The McCarthy has also been criticized for the amount of clerical work involved in transforming the 18 subtest scores into Index Scores on the six scales.

**Summary of preschool assessment measures.** As can be ascertained from this brief review of preschool intelligence tests, there are few instruments available for the purpose of psychoeducational assessment of preschoolers. Each of the three tests discussed possesses a number of strengths and weaknesses. The Stanford-Binet is best suited for providing a global measure of the child's intellectual functioning and an indication of what the child can do, which allows for developing appropriate intervention techniques based upon the child's strengths rather than weaknesses. However, as noted, some degree of caution is warranted regarding diagnostic classification based upon the child’s IQ score (Achenbach, 1970; 1971; Bloom et al., 1976). Inconsistencies in the level of difficulty between the various test items, both within each age level and between age levels, have also contributed to the problem of classification (Lutey, 1981; Davis & Rowland, 1974).

The WPPSI also provides a global measure of intelligence in addition to providing some information concerning the child's pattern of differential strengths and weaknesses. However, this test is extremely limited in terms of its age range (i.e., 4 to 6 1/2) and by the inadequate floor and ceiling levels for the various subtests.
Given the critical problems and drawbacks of both the Stanford-Binet (e.g., item variability and classification) and WPPSI (e.g., limited age range and inadequate floor and ceiling), these tests may not be the most suitable for the assessment of preschool children, particularly exceptional preschoolers. The MSCA would appear to represent a clear alternative to either the Stanford-Binet or WPPSI. Some concern was advanced regarding a possible GCI-IQ discrepancy, especially for children experiencing learning disabilities or mental retardation (e.g., Levenson & Zeno, 1979; Goh & Youngquist, 1979). However, it has been demonstrated that the discrepancies observed were attributable to inadequate experimental controls and intrinsic differences between the various scales (Bracken, 1981; Naglieri, 1980). It has been reported that the MSCA is useful for identifying children "at risk" for future learning difficulties and predicting the performance of kindergarten children over a five year period (Sturner et al., 1984; Massoth, 1985).

Several considerations speak to the need for the development of additional preschool intellectual measures. As can be seen from the preceding discussion, the number of tests available for the assessment of exceptional preschool children is limited. Of the three major intellectual measures reviewed, the MSCA appears to be the most appropriate in evaluating preschool children with learning
deficits and/or developmental delays. However, even the MSCA may be limited in its usefulness as a diagnostic instrument with certain exceptional populations. For example, in testing children with a language handicap, it may not be feasible to utilize a conventional measure of intelligence given the linguistic demands, both expressive and receptive, of such tests (Sattler, 1982).

Given that the selection of general and overall measures of cognitive functioning is limited, there is ample opportunity for the development of an additional preschool intellectual measure. One such addition, the Kaufman Assessment Battery for Children, which will be described in the following sections, attempts to address the need for a measure of intellectual functioning that is less dependent upon linguistic abilities.

Development of the Kaufman Assessment Battery for Children

The Kaufman Assessment Battery for Children (K-ABC) was developed by Kaufman and Kaufman (1983a) as an individual measure of intelligence for children between two and a half and 12 1/2 years of age. The lower bound of two and a half was selected because it represents the transitional period from Piaget's sensorimotor to preoperational stages of development. Similarly, 12 1/2 years of age was selected for the upper bound since this period represents the child's transition to formal operations (Kaufman & Kaufman, 1983a).

The goals of the K-ABC as outlined in the Interpretive Manual are:
1. To measure intelligence with a strong theoretical and research base.
2. To separate acquired knowledge from problem solving ability.
3. To yield scores that translate to educational intervention.
4. To include novel tasks.
5. To be easy to administer and have objective scoring procedures.
6. To be sensitive to the needs of preschool, minority group, and exceptional children (Kaufman & Kaufman, 1983c, p. 5).

The last goal is especially pertinent to this study, in that the K-ABC Mental Processing subtests were specifically designed to minimize the role of verbal abilities and to limit the need for verbalization. The rationale was that many preschool and exceptional children, particularly those experiencing a language impairment, fail to understand items on traditional IQ tests. Consequently, these tests may underestimate these children's abilities. The K-ABC has attempted to address this issue by providing "teaching items" in order to ensure that the child comprehends the demands of the task. In addition, the reduced language demands of the Mental Processing Scales may allow for a more valid estimate of the intellectual functioning of children with a language disability (Kaufman, 1984; Kaufman & Kaufman, 1983c).
Theoretical basis of the K-ABC. Unlike the WPPSI, MSCA, and Stanford-Binet, the K-ABC was designed from an explicit theoretical perspective of intelligence testing. Kaufman and Kaufman (1983c) have utilized the information processing model represented by the Luria-Das theory of successive and simultaneous processing (Das, Kirby, & Jarman, 1979; Das, 1984a). Apart from integrating an information processing perspective into the K-ABC, Kaufman and Kaufman (1983c) have made a distinction between mental processing and achievement. That is, the authors have attempted to separate acquired, factual knowledge from the ability to solve novel problems. This dichotomy corresponds to the distinction made by Cattell (1971) between fluid and crystallized intelligence. Consequently, one set of subtests evaluates the child's cognitive strategies and processes, while a second set assesses the child's knowledge structures (Goetz & Hall, 1984).

While the K-ABC may not be the first intelligence test that is based upon a theory of intelligence (e.g., Thurstone's Test of Primary Abilities), it is more closely related to an explicit theory than are the WPPSI, Stanford-Binet, or MSCA (Sternberg, 1984). Consequently, prior to describing the nature and content of the K-ABC, its theoretical basis will be explored.

Simultaneous and Successive Processing. Two of the three Global Scales of the K-ABC are assumed to assess the child's cognitive strategies: the Sequential Processing
Scale and the Simultaneous Processing Scale. These scales were derived, in large part, from the work of Das and his colleagues (Das, 1984a, 1984b; Das Kirby, & Jarman, 1979) who emphasized simultaneous and successive processing.

The Das model is based upon Luria's (1980) classical observations of the brain for which he proposed that there are three major functional divisions. These divisions are: Unit 1 (upper and lower brain stem, reticular formation, and hippocampus) which is responsible for arousal; Unit 2 (occipital, temporal, and parietal lobes) which is concerned with obtaining, processing, and storing information; and Unit 3 (frontal lobes) which is involved in the planning and programming of behavior.

Das et al. (1979) have speculated upon the relationship between intelligence and these three units of the brain. The authors maintain that the focus of current intelligence tests has been concerned with coding of information in either a simultaneous or successive fashion, a characteristic of Unit 2. The planning and programming functions of Unit 3 are only indirectly measured by intelligence tests (Das et al., 1979).

Das and his colleagues (1979) proposed a model of information processing that is based upon Unit 2. In this instance, cognitive processes are differentiated into those concerned with coding and those involving planning. Coding functions pertain to the reception, analysis, and synthesis of incoming information into either a simultaneous pattern
or sequential array (Das et al., 1979).

Simultaneous integration involves the synthesis of separate elements into groups which possess spatial characteristics (Das, Kirby, & Jarman, 1975). Accordingly, any portion of the information encoded in such a manner may be analyzed independent of its relationship to the whole. The simultaneous synthesis of information may occur in one of three ways: 1) through direct perception in which the individual selectively attends to a stimulus input, 2) through a mnestic process (memory) in which stimulus traces are organized from an earlier experience (i.e., gestalt closure task), and 3) through complex intellectual processes by which the individual may determine the relationship of various systems (Das et al., 1975).

Successive or sequential processing involves the interpretation of stimuli one at a time in a serial fashion, or feature by feature (Das, 1984a). Information which is integrated in a successive manner, in contrast to simultaneous integration, cannot be observed as a system or a whole at any one point in time (Das et al., 1979). In other words, any information within the system is dependent upon its position and relationship to the stimuli preceding and following it. Successive processing may also occur in one of three ways: 1) perceptual, 2) mnestic, and 3) complex intellectual. According to Das et al. (1979), an example of complex successive processing would involve the synthesis of human language.
In this model of information processing, sensory input is received by the central processing unit, which consists of three components: a simultaneous grouping; a successive grouping; and a decision making and planning component. The two modes of processing, simultaneous and successive, are available to each individual. The selection of the particular mode is determined by the individual's habitual style of processing and by the demands of the task (Das et al., 1979). Once the information has been encoded in one of two ways, the third component (cognition) determines the manner in which the input is to be utilized.

**Crystallized and Fluid Intelligence.** The second model of intelligence utilized in the development of the K-ABC concerns the theory proposed by Cattell (1963, 1971) and Cattell and Horn (1978). In this model, intelligence is conceptualized as consisting of two components, a "fluid" (Gf) component and a "crystallized" (Gc) component. Fluid intelligence is concerned with those mental operations or processes that involve the perception of complex relationships with little informational content. Cattell (1963) noted that tasks assessing fluid ability are less reliant upon past experience or long term memory and require judgement and reasoning which are relatively culture free. Such tasks require abilities such as classification and analogy which are not generally acquired through education (Cattell 1963). Fluid intelligence is most evident in tasks requiring spatial reasoning, inductive reasoning, and,
to a lesser extent, numerical and verbal reasoning skills (Cattell, 1963).

Crystallized intelligence, in contrast, concerns mental products and achievements and generally draws upon the individual’s acquired knowledge and skills (e.g., information, vocabulary, and formal logical reasoning) (Cattell, 1971). Crystallized ability has most often been associated with measures of achievement and traditional tests of intelligence assessing verbal ability, reasoning, and numerical ability. However, Cattell (1963) maintains that crystallized ability is not identical to scholastic achievement which depends to a large extent upon rote memory. Rather, this ability involves reasoning skills that have been acquired through the utilization of fluid ability (Cattell, 1963). This distinction can be seen in an example provided by Jensen (1980) which analyzes verbal analogies in relation to the fluid-crystallized dichotomy:

**Analogy 1:** Grass is to Cattle as Bread is to Man Butter Water Bones

**Analogy 2:** Pupil is to Teacher as Aristotle is to Socrates Plato Philosopher Homer

Analogy 1 is based upon highly familiar words, but requires a degree of relational logic and is therefore a measure of fluid ability. While Analogy 2 requires the same relational logic and consequently, fluid ability, this analogy is based upon specialized words which are the product of formal education and is therefore a measure of crystallized ability.
ability.

In summary, Kaufman and Kaufman (1983c) have developed the K-ABC upon a theoretical foundation that utilizes the Das-Luria model of Simultaneous and Successive Processing and the Cattell-Horn theory of Fluid and Crystallized intelligence. The K-ABC consists of 16 subtests which are divided into Mental Processing tasks which theoretically reflect the Das-Luria theory as well as Cattell's notion of fluid ability, and Achievement tasks which are reliant upon crystallized ability (see Figure 1). The 10 Mental Processing subtests are further divided into Sequential subtests) and Simultaneous (7 subtests) Processing Scales.

In all, five Global Scales may be obtained from the K-ABC. Three of the Global Scales comprise the measure of intellectual functioning. The Sequential and Simultaneous Processing scales provide information about the child's processing abilities. The third scale (Mental Processing Composite) is obtained by summing the Sequential and Simultaneous scores, and represents an overall measure of the child's processing skills. The fourth Global Scale, the Achievement Scale, consists of tasks found in conventional intelligence tests (Kaufman & Kaufman, 1983c). A fifth scale, the Nonverbal Scale, consists of those subtests that do not require verbal responses and have instructions that can be provided in pantomime.

Psychometric properties of the K-ABC

Norms. Two thousand children, between the ages of two
**Kaufman Assessment Battery for Children**

<table>
<thead>
<tr>
<th>Fluid Intelligence</th>
<th>Crystallized Intelligence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(Cattell-Horn Theory)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>(Das-Luria Theory)</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Simultaneous</th>
<th>Successive/Sequential</th>
<th>Achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magic Window</td>
<td>Hand Movement</td>
<td>Expressive Vocabulary</td>
</tr>
<tr>
<td>Face Recognition</td>
<td>Number Recall</td>
<td>Faces &amp; Places</td>
</tr>
<tr>
<td>Gestalt Closure</td>
<td>Word Order</td>
<td>Arithmetic</td>
</tr>
<tr>
<td>Triangles</td>
<td></td>
<td>Riddles</td>
</tr>
<tr>
<td>Matrix Analogies</td>
<td></td>
<td>Reading Decoding</td>
</tr>
<tr>
<td>Spatial Memory</td>
<td></td>
<td>Reading Recognition</td>
</tr>
<tr>
<td>Photo Series</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Figure 1.* Theoretical foundation and subtest classification of the Kaufman Assessment Battery for Children.
and a half and 12 1/2, selected from 34 test sites in 24 states were assessed. The children were divided into 20 age groups at six month intervals. Stratification variables included: sex, geographic region, socioeconomic status, race, community size, and educational placement. Supplementary sociocultural norms were also developed in order to provide sociocultural percentile ranks for the Global Scales.

Scores. Raw scores are converted to standard scores with a mean of 10 and a standard deviation of three. These Scale Scores, are then summed separately for the Sequential or Simultaneous Scales and are converted into Standard Scores with a mean of 100 and a standard deviation of 15. All of the Achievement subtests also use a mean of 100 and standard deviation of 15. The Standard Errors of Measurement (SEM) for preschool age children (2 1/2 to 4-11) range from 3.9 (Achievement) to 5.7 (Simultaneous). The mean SEM for school age children (5 to 12 1/2) range from 2.7 (Achievement) to 5.0 (Sequential).

Reliability. In their Interpretive Manual, Kaufman and Kaufman (1983c) present comprehensive reliability data. Split half reliabilities were computed for the entire standardization sample for both subtests and Global Scales (see Kaufman & Kaufman, 1983c, Tables 4.1 and 4.2, pp. 82-83). Reliability data are summarized below.

Subtest. The mean reliability across ages equaled or exceeded .80 for 12 of the 16 subtests. For preschoolers
specifically, the reliability coefficients for the Mental Processing subtests ranged from .72 for Magic Windows to .88 for Number Recall. Coefficients were higher for the Achievement subtests and ranged from .77 for Faces & Places to .92 for Reading/Decoding. For school age children the reliability coefficients ranged from .71 for Gestalt Closure to .85 for Matrix Analogies. Mean reliability coefficients for the Achievement subtests ranged from .84 (Faces & Places) to .91 (Reading and Understanding) with only one coefficient in the entire sample below .80.

**Test-retest reliability.** Test-retest reliability was determined by readministering the K-ABC to 246 children who spanned the entire age range. An interval of two to four weeks (M = 18 days) elapsed between testings. The sample was divided into three age groups: 2 1/2 to 4; 5 to 8; and 9 to 12 1/2.

**Global Scales.** The reliability data revealed that the Global Scales are quite stable, although this stability does increase with age. For preschool children, the reliability coefficients ranged from .77 (on Sequential and Simultaneous Scales) to .95 (on Achievement). The mean coefficients for 5 to 8 year olds and 9 to 12 1/2 year olds were .88 and .92, respectively.

**Subtests.** At the preschool level, Mental Processing subtest reliabilities ranged from .62 (Hand Movements) to .85 (Word Order). The Achievement subtests for this age range yielded higher values ranging from .72 (Riddles) to
.87 (Arithmetic). For school age children reliability coefficients on the Mental Processing scale ranged from .61 to .84 for 5 to 8 year olds and from .59 to .86 for 9 to 12 1/2 year olds. Achievement subtest reliability for the two groups of school age children ranged from .87 to .98 (5 to 8) and .90 to .94 (9 to 12 1/2).

Validity of the K-ABC

The validity section of the Interpretive Manual is based upon 43 validity studies conducted by independent researchers on normal and special populations (see Kaufman & Kaufman, 1983c, Table 4.12, pp. 94-99). The amount of data reported by the authors is extensive; consequently, for the purposes of this discussion, only information relevant to the present study will be examined (i.e., preschool children and exceptional populations). Of the 43 validity studies reported, eight deal specifically with preschool children and only two of these focus upon special populations (i.e., physically impaired and high risk preschoolers). The results of additional validity studies involving preschoolers will also be described below. Interestingly, despite the high incidence of language impairments reported in preschool children (e.g., Cantwell & Baker, 1980; Baker & Cantwell, 1983; Beitchman et al., 1986), none of the studies to be reviewed have examined the validity of the K-ABC within this preschool population. In addition, only one study investigated the effects of behavior problems on K-ABC results, and this study involved a school age sample.
Construct validity. Kaufman and his colleagues (Kaufman & Kaufman, 1983c; Kaufman & Kamphaus, 1984; Willson, Reynolds, Chatman, & Kaufman, 1985) conducted factor analytic studies to support the dichotomy of the Mental Processing Scale into Simultaneous and Sequential divisions. Two different approaches were utilized: principal factor analysis and confirmatory factor analysis. Principal factor analysis is generally employed when researchers do not have an idea of how many underlying dimensions there are for a given set of data (Kim & Mueller, 1978). Principal factor analysis may then be used to determine the minimum number of hypothetical factors that can account for the covariance observed. This type of analysis is considered to be exploratory in nature. In contrast, researchers may anticipate or hypothesize about the underlying dimensions (e.g., sequential vs. simultaneous processing) of a particular set of observations. For example, the researcher may decide, on an a priori basis, that a set of variables (e.g., Word Order & Number Recall) will represent one factor, while a second set of variables (e.g., Gestalt Closure & Magic Window) represents a second factor. In this instance, factor analysis utilized to test such hypotheses is referred to as confirmatory factor analysis (Kim & Mueller, 1978).

In a study employing principal factor analysis, Kaufman and Kamphaus (1984) reported evidence for the existence of Sequential and Simultaneous constructs across the entire
K-ABC age range (i.e., 2 1/2 to 12 1/2). The analyses yielded three significant dimensions for six of 11 age groups, and two significant dimensions for ages 2 1/2 3 4 5, and 10. Using varimax rotation to simplify the factor solution, it was evident that three factors best represented the data for ages four through 12 1/2. A two factor solution (i.e., Sequential and Simultaneous/Achievement) was most appropriate at ages 2 1/2 and 3. In general, the Sequential and Simultaneous constructs were demonstrated across the entire age range (Kaufman & Kaufman, 1983c; Kaufman & Kamphaus, 1984). More recently, the examination of principal factor solutions for the K-ABC confirmed its factor structure for preschool and school age boys and girls (Kamphaus & Kaufman, in press).

A confirmatory factor analysis was conducted in an attempt to provide evidence for the theoretical framework of the K-ABC (Willson et al., 1985). This method of analysis was considered most appropriate since it allowed for a test of the "goodness of fit" of the Simultaneous-Sequential Processing dichotomy. A two factor solution examined the subtests on the Processing Scales only, and a three factor solution included the Achievement subtests for the entire age range. The results of the two factor analysis clearly indicated that the Simultaneous and Sequential factors may be considered independent constructs underlying the K-ABC (Willson, et al., 1985). When the three factor solutions were considered, the Simultaneous and Sequential factors...
were evident, as was the Achievement factor, across all ages with the exception of children 2 1/2 years of age.

In summary, the confirmatory and exploratory factor analyses provide evidence for the processing dichotomy of the K-ABC across the entire age range sampled. Of particular importance were the findings of the confirmatory analyses which attested to the construct validity of the K-ABC. It is evident that the Sequential and Simultaneous dimensions are robust across the entire K-ABC age range.

In several recent studies, Keith (Keith & Dunbar, 1984; Keith, 1985) examined the construct validity of the K-ABC. Utilizing three age levels from the K-ABC standardization sample, both exploratory and confirmatory factor analyses were conducted. The results supported the Sequential and Simultaneous dichotomy, although an alternative set of names for the Processing Scales and Achievement scale was generated. Keith (1985) has suggested that the test provides measures of primarily verbal and verbal mediated memory (Sequential Scale), verbal reasoning (Achievement Scale), and nonverbal reasoning skills (Simultaneous Scale) (see Figure 2). The factor structure of the K-ABC was also examined in relation to referred school age children (Keith, 1986). Two major conclusions were drawn from this study: 1) the K-ABC appears to measure the same factors across groups (e.g., normal vs. exceptional), and 2) while the factor structure of the K-ABC is stable, the constructs being assessed may represent verbal memory, verbal
### General Ability ("g")

<table>
<thead>
<tr>
<th>Verbal Memory</th>
<th>Nonverbal Reasoning</th>
<th>Verbal Reasoning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand Movements</td>
<td>Gestalt Closure</td>
<td>Faces &amp; Places</td>
</tr>
<tr>
<td>Number Recall</td>
<td>Triangles</td>
<td>Arithmetic</td>
</tr>
<tr>
<td>Word Order</td>
<td>Matrix Analogies</td>
<td>Riddles</td>
</tr>
<tr>
<td></td>
<td>Spatial Memory</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Photo Series</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 2.** Alternate factor structure for the K-ABC as proposed by Keith and Dunbar (1984).
reasoning, and nonverbal reasoning as opposed to sequential and simultaneous processing and achievement.

Kaufman (1984), in a review of the Keith and Dunbar study (1984), suggests that this alternate model may be useful when a specific pattern of strengths and weaknesses is evident on the Achievement Scale, such that the Reading subtests form one group and the remaining subtests (i.e., Faces & Places, Arithmetic, Riddles) group according to the Verbal Reasoning Factor. The validity of the Verbal Memory and Nonverbal Reasoning factors however, is questioned by Kaufman (1984) who argues there is no evidence of support for these labels. In subsequent factor analyses, Kaufman and MacLean (1985;1986) demonstrated that the K-ABC factors were evident in samples of learning disabled and normal school age children. However, Kaufman and MacLean (1986) have noted that Keith's (1985;1986) interpretation of the K-ABC factor structure is "quite feasible". Although Keith's (1985; 1986) interpretation may be plausible for school age children, Kamphaus and Kaufman (in press) have argued that this position is not defensible for preschool age children. Clearly further research which examines this alternate model using samples other than the standardization data is required.

Various researchers (e.g., Klanderman, Devine, & Mollner, 1985; McCallum, Karnes, & Oehler-Stinett, 1985; Naglieri, 1985a; 1985b; Obzrut, Obzrut, & Shaw, 1984) have examined the K-ABC's ability to differentiate young children
on the basis of some exceptionality such as giftedness, learning disability, borderline mental retardation, or behavior disorder. McCallum et al., (1985) administered the K-ABC to elementary school children who had been identified as gifted on the basis of their performance on either the Stanford-Binet or Wechsler Intelligence Scale for Children-Revised (WISC-R). The authors questioned the K-ABC's capacity to assess highly verbal children and raised the possibility that the test may be measuring different abilities in these children than in nongifted children. The results indicated that the factor structure for the gifted children (i.e., Sequential & Simultaneous) was similar to that of the standardization sample, although the grand means for the scales were 15 points lower than the 130 point cutoff for gifted children. In addition, the results were more dependent upon specific and/or error variance than the results from average children, that is, the factor structures for these children accounted for only one-third of the common test variance. This finding raises questions regarding the issue of programming on the basis of test scores. In other words, the accuracy of placement decisions (e.g., a class for the gifted) based upon the child's performance on the K-ABC may be questionable when the scores may not represent the child's actual level and pattern of intellectual functioning.

Naglieri (1985a; 1985b) and Obzrut et al. (1984) investigated the construct validity of the K-ABC with
children experiencing either learning disabilities or developmental delays. While evidence of the K-ABC's construct validity as a measure of intelligence was obtained, the test failed to identify children classified as mentally retarded by the WISC-R. Nor did the test reveal a distinct processing profile for children with learning disabilities (Naglieri, 1985b). Obzrut et al. (1984) concluded that an apparent weakness of the K-ABC involves the exclusion of verbal or language measures which may in turn, limit its usefulness in the diagnosis of possible mental retardation and more severe language-related disorders.

Two validity studies examined the performance of children identified as either behaviorally disordered (Nelson, 1983) or at "high risk" for poor adjustment in kindergarten (Klanderman, Wisehart, & Alter, 1983). The K-ABC was administered to 43 children ranging in age from six years, nine months to 12 years two months, who had been placed in Behavior Disorder classes. They were designated as experiencing a behavior disorder on the basis of the following criterion: the child must be experiencing an affective and/or adaptive behavior problem(s) which significantly interferes with his/her learning potential and social functioning (L.E. Nelson, personal communication, August 7, 1986). The results of this study did not reveal any significant discrepancies between Scale Scores on the K-ABC or WISC-R (Nelson, 1983; Kaufman & Kaufman, 1983c).
An analysis and comparison between children with behavior problems and those with learning disabilities, as reported in the K-ABC Interpretive Manual, revealed few differences in their test performances. With the exception of Number Recall (a strength for the behavioral group) and Spatial Memory (a weakness for the behavioral group), Standard Scores on the Mental Processing Scales were quite similar (Kaufman & Kaufman, 1983c). However, performances on the Achievement Scale were somewhat different in that the children with behavior disorders scored two points higher on the Achievement Scale, while children with learning disabilities scored five points lower on the Achievement Scale than on the Mental Processing Composite Scale. In addition, children with behavior disorders obtained higher scores on each Achievement subtest (3 to 7 points higher) than children with learning disabilities, although there were no reported tests of significance in the manual. Kaufman and Kaufman (1983c) caution that no conclusions should be drawn from the pattern of results obtained by Nelson (1983), or from the Achievement Scale's ability to differentiate learning disabled and behaviorally disordered children until additional studies are completed.

The Klanderman et al. (1983) study examined the performance of 28 preschoolers, ranging in age from two years nine months to five years 11 months, on the K-ABC and the Stanford-Binet Intelligence Scale. Each child was identified as at "high risk" for poor adjustment in
kindergarten through a screening procedure, and each child was experiencing language delays as well as high levels of activity. An overall correlation coefficient of .66 was obtained between the Stanford-Binet (M = 88.9) and the K-ABC Mental Processing Composite (M = 89.6) Correlation coefficients for the remaining scales were reported to be in the mid .50s. No discrepancy was noted between the children's performance on the Mental Processing Composite (M = 89.6) and Achievement Scale (M = 89.2), although they demonstrated an almost three point difference between the Sequential Processing (M = 92.5) and Simultaneous Processing (M = 89.8) scales. This group obtained higher scores on tasks requiring visual-motor coordination (e.g., Hand Movements, Triangles, and Matrix Analogies) than on tasks requiring verbal ability (e.g., Number Recall, Word Order, and Magic Window). This pattern of results was attributed to poor attention and/or distractibility, as well as to difficulties in verbal ability as a function of language delays (Kaufman & Kaufman, 1983c). The findings however, were possibly confounded by an interaction between behavioral difficulties (e.g., distractibility) and language impairment.

Concurrent and predictive validity. A number of studies have been conducted (e.g., Harnett & Fallendorf, 1983; Durham, Childers, & Bolen, 1983; Klanderman, Brown, Stranges, & Page, 1983; Bracken, 1983) comparing the performance of young children on the K-ABC and other
traditional intellectual measures (e.g., WPPSI, Stanford-Binet, & MSCA). The K-ABC has also been compared with individual achievement tests such as the PPVT-R and Slosson Intelligence Test (Bing & Bing, 1985; McLoughlin & Ellison, 1983; Lampley & Rust, 1986). Examination of these studies has indicated that these measures are more highly correlated with the Achievement Scale than with the Mental Processing Composite Scale (see Table 1). Consequently, the results pertaining to the MPC and Achievement Scales will be described separately.

Moderate correlations have been reported between the K-ABC Mental Processing Composite Scale and conventional tests of intelligence. In a study that compared the performance of 40 preschoolers on the WPPSI to the K-ABC, an overall correlation of .55 was noted (Hartnett & Fallendorf, 1983). The comparison of the Stanford-Binet and K-ABC Mental Processing Composite Scale produced correlation coefficients of .36 and .65, in two groups of normal preschoolers (Durham et al., 1983; Klanderman, Brown, Stranges, & Page, 1983). Similar correlations between the K-ABC Mental Processing Composite Scale and the MSCA General Cognitive Index Scale were reported by Bracken (1983) and Klanderman, Stranges, and Page (1983). In these two studies involving preschoolers, the Mental Processing Composite and General Cognitive Index Scores were correlated .60 and .68, respectively. In a related study, the K-ABC, Stanford-Binet, and WISC-R were administered to 40 school
Table 1
Correlations of the K-ABC Global Scales with measures of intelligence and achievement

<table>
<thead>
<tr>
<th>Source</th>
<th>N</th>
<th>Measure</th>
<th>MPC</th>
<th>SEQ</th>
<th>SIM</th>
<th>ACH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hartnet &amp; Fallendorf (1983)</td>
<td>40</td>
<td>WPPSI FSIQ</td>
<td>.55</td>
<td>.46</td>
<td>.47</td>
<td>.66</td>
</tr>
<tr>
<td>Zin &amp; Barnett (1984)</td>
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<td>WISC-R FSIQ</td>
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<td>.74</td>
<td>.81</td>
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<td>Durham et al. (1983)</td>
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<td>Stanford-Binet IQ</td>
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<tr>
<td>Klanderman, Brown, Stranges, &amp; Page (1983)</td>
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<td>Stanford-Binet IQ</td>
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<td>.58</td>
<td>.74</td>
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<tr>
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<td>Stanford-Binet IQ</td>
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<td>.54</td>
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<tr>
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<td>MSCA GCI</td>
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<td>.75</td>
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<tr>
<td>Klanderman, Brown, Stranges, &amp; Page (1983)</td>
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<td>MSCA GCI</td>
<td>.68</td>
<td>.70</td>
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<tr>
<td>McLoughlin &amp; Ellison (1984)</td>
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<td>PPVT-R Form L</td>
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<td>.66</td>
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<tr>
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<tr>
<td>Kaufman &amp; Kaufman (1983c)</td>
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<td>.33</td>
<td>.51</td>
<td>.71</td>
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<tr>
<td>Lampley &amp; Rust (1986)</td>
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<td>.50</td>
<td>-.37</td>
<td>.34</td>
<td>.73</td>
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<td>Cooley &amp; Ayres (1986)</td>
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<td>PIAT Reading Comp.</td>
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<td>53</td>
<td>.48</td>
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<td></td>
<td>Reading Recog.</td>
<td>.69</td>
<td>.61</td>
<td>.51</td>
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</table>

MPC = Mental Processing Composite  SEQ = Sequential Processing
SIM = Simultaneous Processing      ACH = Achievement

Note: Kaufman and Kaufman (1983c) correlation data was pooled from the K-ABC validation studies reported in the interpretive manual.

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age children (Zin & Barnett, 1984). While a correlation coefficient of .79 was reported between the Mental Processing Composite Scale and WISC-R FSIQ, these summary scores were not directly comparable. A significant difference of five points between these two scales was reported. Although the Stanford-Binet IQ score was also higher (i.e., 2.5 points) than the K-ABC Mental Processing Composite Score, the difference was not significant.

The comparison of the K-ABC Mental Processing Composite Scale with individual tests of achievement has yielded correlation coefficients which are similar to those obtained with intellectual measures (see Table 1). Correlations ranging from .49 to .58 between the Mental Processing Composite Scale and PPVT-R have been reported for preschool children (Bing & Bing, 1985; Kaufman & Kaufman, 1983c). Lampley & Rust (1986) investigated the validity of the K-ABC using the Slosson Intelligence Test with a sample of 50 preschoolers. A correlation coefficient of .50 was reported between the Slosson Intelligence Test and Mental Processing Composite Scale. Significant correlations between the Reading Comprehension ($r = .69$) and Reading Recognition ($r = .59$) subtests of the Peabody Individual Achievement Test and the K-ABC Mental Processing Composite Scale have also been noted (Cooley & Ayres, 1985).

While moderate correlations were generated between the K-ABC Mental Processing Composite Scale, IQ tests, and achievement scales, a review of these studies has revealed
that, in many instances, the Achievement Scale of the K-ABC produced the highest correlation coefficients. The K-ABC Achievement Scale produced correlation coefficients of .66 with the WPPSI; .57 and .74 with the Stanford-Binet; and .73 and .75 with the MSCA. Comparable correlation coefficients between the Achievement Scale and PPVT-R ($r = .76$, $r = .71$, and $r = .60$), and Slosson Intelligence Test ($r = .73$) were evident. This pattern might be expected since most traditional intellectual measures have been "contaminated" with achievement (Kaufman, 1984).

In summary, numerous studies of the K-ABC have been conducted addressing the issues of construct, concurrent, and predictive validity. While factor analytic studies have demonstrated that a dichotomy exists for the Processing Scales, various researchers have provided different labels for these factors. Kaufman and his colleagues (Kaufman & Kaufman, 1983c; Kaufman & Kamphaus, 1984; Willson et al., 1985) maintain that their analyses substantiate the Simultaneous versus Sequential distinction. Keith (1985, Keith & Dunbar, 1984) has provided an alternate set of labels, Verbal Memory and Nonverbal Reasoning, for the Sequential and Simultaneous Scales, respectively. Clearly there is some question as to what the K-ABC actually measures.

Apart from the research centering upon the K-ABC's factor structure, concerns arise regarding its capacity to differentially classify exceptional children. A number of
authors (e.g., Klanderman et al., 1985; Obzrut et al., 1984; Naglieri, 1985a, 1985b) have demonstrated that the K-ABC failed to identify educable mentally retarded children, or to reveal a distinct processing profile for children with learning disabilities. McCallum et al. (1985) reported that the K-ABC did not differentiate gifted children from normal children. In addition, the significance of the test performance of preschoolers identified as being "high risk" was confounded by a possible interaction between behavioral difficulties and language delays. It is important to isolate the effects of language delays and behavioral difficulties given the high incidence of these problems with the preschool population (Baker & Cantwell, 1983; Beitchman et al., 1986). The role of language ability in relation to the K-ABC is not readily apparent at the present time. It is evident that the K-ABC's reduced emphasis on verbal or language measures may result in higher scores with certain groups of exceptional children. Bryen and Gallagher (1983) have emphasized the need for the assessment of language skills in preschool children since linguistic processes are important precursors for other complex abilities.

Information obtained from concurrent validity studies that compared the K-ABC with the Stanford-Binet, WPPSI, and MSCA intelligence tests revealed moderate to low correlation coefficients. In many instances the Achievement Scale of the K-ABC was most correlated with the overall IQ scores. Some variability was also apparent in the correlations
between the K-ABC Mental Processing Composite Score and IQ scores (e.g., Durham et al., 1983; Klanderman et al., 1983). Zins and Barnett (1984) noted that the WISC-R and K-ABC Summary Scores are not directly comparable. At present it is difficult to ascertain the reason for such discrepancies. Similar findings were reported in studies utilizing achievement measures (e.g., Bing & Bing, 1985; McLoughlin & Ellison, 1984).

The following section will evaluate and critique the K-ABC in terms of its psychometric properties and validity. Several sources of difficulty will be examined and possible explanations or solutions will be explored.

**Evaluation and critique of the K-ABC**

The K-ABC is a relatively new instrument for assessing the intelligence and achievement of preschool and school age children. While the psychometric properties of the K-ABC are well within the limits established in the Standards for Educational and Psychological Tests (APA, 1974), several limitations are evident. In his analysis of the psychometric properties of the K-ABC, Mehrens (1984) has discussed some of these limitations. For example, he expressed some concern regarding the lack of information about the proportion of children who refused to participate, the lack of stability reliability (i.e., test-retest) for more than a two to four week period, and the lack of predictive validity for more than a one year period.

In a critical review of the K-ABC, Bracken (1985)
addressed a number of technical and design problems. The author examined in some detail the floor and ceiling characteristics of the Mental Processing Scale. It is reported for example, that not until the age of 6 is it possible for a child to obtain a Mental Processing Composite score of less than 55 due to standard scores associated with zero credit on some K-ABC subtests. This finding is extremely critical in relation to the assessment of moderately retarded (i.e., IQs between 35 & 55) and lower functioning children (Bracken, 1985). In addition, significant differences between the Sequential and Simultaneous Processing Scales at the lower ability and age levels should be interpreted cautiously because of the floor effects.

Similarly, some older children may earn the maximum allowable credit on each K-ABC subtest, and their subtest standard scores still remain within two standard deviations of the mean. While the range of subtest standard scores is limited, the child may still obtain an Mental Processing Composite score that is more than three standard deviations from the mean. This occurs as a result of the probability that a child will receive the maximum standard score on each subtest being less than the probability of obtaining the maximum credit on a single task (Bracken, 1985). This finding has an adverse effect on the ipsative (i.e., relative performance) interpretation of a test protocol since a gifted student obtains truncated scores on the
various subtests (Bracken, 1985). Similar restrictions are cited for the Achievement subtests. The limited range of Achievement subtest scores results in significant Achievement Scale versus Mental Processing Composite score discrepancies (Bracken, 1985).

Kaufman and Kaufman (1983c) describe the K-ABC as a measure of the "individual's style of solving problems and processing information" (p. 2). The authors maintain that the Sequential Processing and Simultaneous Processing Scales represent two types of mental functioning, and they stress the importance of significant differences between these scales. However, some degree of caution is warranted in terms of the inferences that may be drawn from such differences or as to what each scale assesses.

The validity of the Mental Processing Scales may be examined in terms of the degree of correspondence between the test and the Das-Luria theory. Bracken (1985) and Sternberg (1984) maintain that the Sequential Processing scale is little more than a measure of rote learning. As noted previously, Das's theory suggests that sequential processing may be perceptual, mnestic, or conceptual (i.e., language-related) in nature. Given that Kaufman and Kaufman (1983c) intentionally minimized the language demands of the Sequential subtests, these tasks emphasize auditory and visual short-term memory. This emphasis is reflected in Keith's (1985) claim that the Sequential Processing Scale may measure verbal and verbal mediated memory. Goetz and
Hall (1984) have also argued that this scale may be dependent upon cognitive structures, strategies, and functions which are not directly assessed by the K-ABC. In addition, Das (1984a) as well as Goetz and Hall (1984) have argued that the Sequential Processing subtests are variations of standard memory span tasks, thus supporting the positions of Sternberg (1984) and Bracken (1985) that this scale is simply a measure of memory skills. Finally, Bracken (1985) states that the omission of a complex conceptual task on this scale reduces the effectiveness by which a child's performance may be translated into remediation and intervention strategies addressing classroom learning.

Similar criticisms have been raised concerning the Simultaneous Processing Scale. Sternberg (1984) and Goetz and Hall (1984) have noted that several of the Simultaneous tasks also involve memory (e.g., Face Recognition and Spatial Memory). Bracken (1985) maintains that the majority of tasks on this scale evaluate automatic processing (e.g., Photo Series, Triangles and Matrix Analogies). This position corresponds somewhat with Keith's (1985) hypothesis that this scale assesses nonverbal reasoning or processing.

Bracken (1985) examined the disproportionate distribution of Sequential (3 subtests) and Simultaneous (7 subtests) Processing tasks. Kaufman and Kaufman (1983a) indicate that only five of the seven Simultaneous tasks are administered at any one time thereby controlling for this
imbalance. However, an examination of the Mental Processing Composite score reveals that it is not equally weighted for the two processing scales (Bracken, 1985). The Mental Processing Composite Scale is actually weighted more for the Simultaneous Scale as a function of the Sequential-Simultaneous distribution. Bracken (1985) notes for example, that a 10 year old child earning a Global Scale score of 100 on the Sequential Scale and a score of 85 on the Simultaneous Scale will obtain a Mental Processing Composite score of 89. However, if this pattern is reversed the resultant Mental Processing Composite score is 95, six points higher. Therefore, the Mental Processing Composite score does not equally represent both types of processing, rather the ratio is approximately 3:2, Simultaneous versus Sequential, thus placing more emphasis on the former scale. This finding contradicts Das's (1984a) model of information processing in which simultaneous and successive processes are not organized in an hierarchical manner.

The K-ABC was also constructed utilizing Cattell's (1963) theory of crystallized and fluid intelligence. In this instance, the Processing Scales are assumed to measure fluid ability, while the Achievement Scale was thought to reflect crystallized ability (Kaufman & Kaufman, 1983a). As indicated previously, Cattell (1963) stated that fluid ability is less reliant upon memory and requires judgement and reasoning skills. The Sequential subtests of the K-ABC apparently do not assess those abilities described by
Cattell, but measure short-term memory skills (Das, 1984a; Goetz & Hall, 1984; Sternberg, 1984; Bracken, 1985; Keith, 1985; Keith & Dunbar, 1984). In contrast, the Simultaneous subtests may be a more appropriate measure of fluid ability (Bracken, 1985). This analysis corresponds with the factor analytic model presented by Keith (Keith & Dunbar, 1984; Keith, 1985) in which the Simultaneous tasks are assumed to measure nonverbal reasoning abilities, while the Sequential subtests assess verbal and verbal mediated memory.

Kaufman and Kaufman (1983c) propose that the Achievement Scale provides a measure of crystallized intelligence. Recall that Cattell defines crystallized ability as involving reasoning skills that have been acquired through the utilization of fluid ability. Furthermore, Cattell (1963) maintains that crystallized ability is not identical to scholastic achievement which is dependent upon rote memory. According to Bracken (1985), on the basis of an intuitive analysis, only the Riddles task provides a measure of crystallized intelligence. The remaining subtests are purported to be measures of scholastic achievement, relying to a great extent upon rote memory. While this preliminary analysis would suggest that the Achievement Scale is not a measure of crystallized intelligence, the factor analytic studies conducted by Keith (Keith & Dunbar, 1984; Keith, 1985) suggest otherwise. The majority of Achievement subtests loaded on a factor labelled Verbal Ability which involves verbal reasoning skills that
may be assumed to emerge as a result of fluid ability.

Thus far, the evaluation of the K-ABC has revealed that there are a number of controversial issues related to its construct validity. A number of authors (e.g., Bracken, 1985; Das, 1984a; Keith, 1985) have questioned the K-ABC's "goodness of fit" with the Successive-Sequential theory of information processing. Sternberg (1984) and Hall and Goetz (1984) have argued that the Sequential Scale represents a set of standard memory tasks, and that these tasks only measure the mnestic component of sequential processing. Keith (Keith & Dunbar, 1984; Keith, 1985) provides an alternate model for the K-ABC. Bracken (1985) has criticized the K-ABC on its apparent lack of correspondence to Cattell's Fluid-Crystallized theory of intelligence.

The construct validity of the K-ABC has also been examined in terms of its ability to discriminate between various exceptional populations (e.g., learning disabled, gifted, and mentally retarded). Telzrow (1984) has stated that the K-ABC may be useful for the purpose of differential diagnosis of preschoolers. An examination of those studies reviewed in a previous section, indicated that gifted children may not have been given credit for their above-average verbal abilities (McCallum et al., 1985). Naglieri (1985a) and Obzrut et al. (1984) reported that the K-ABC did not identify mentally retarded children, providing IQ scores above the cutoff point. In addition, the test did not reveal a distinct processing profile for learning
disabled children. These failures are attributed to the exclusion of verbal or language measures. The results of these studies clearly contradict some of the predictions made by Kaufman and Kaufman (1983c). For example, it has been suggested by Telzrow (1984) that learning disabled children, particularly those with language difficulties, are characterized by a higher simultaneous than sequential processing score.

The concurrent and predictive validity studies have revealed low to moderate correlations between the K-ABC and other measures of intelligence (e.g., WPPSI, Stanford-Binet, MSCA) as well as with measures of achievement (e.g., PPVT-R and Slosson Intelligence Test). Kaufman and Kaufman (1983c) have purposefully excluded language measures from the Mental Processing Scales: "The K-ABC Mental Processing subtests were deliberately designed to minimize the role of language and verbal skills for successful performance." (p. 2). However, in the majority of concurrent validity studies, the Achievement Scale of the K-ABC, which contains language measures, correlated most highly with overall measures of intelligence. Correlations between this scale and IQ scores ranged from .52 to .79, with a median of .72. It has been argued that this pattern of results brings into question the validity of the Mental Processing Scale as a measure of intelligence (Sternberg, 1984). However, Kaufman (1984) states that the Mental Processing Scales specifically exclude measures which are typically found on conventional
IQ and achievement tests (e.g., verbal concepts, vocabulary, and general information) and therefore should not be as highly correlated with such measures as is the K-ABC Achievement test.

A number of researchers (e.g., Bracken, 1985; Naglieri, 1985a, 1985b; Obzut et al., 1984; McCallum et al., 1985) have emphasized the importance of verbal skills in the measurement of intelligence. In fact, the two theories upon which the K-ABC is based utilize linguistic components in their models (e.g., the complex sequential processing of language). Bryen and Gallagher (1983) have noted that linguistic deficits may be predictive of subsequent learning difficulties. These authors identify the preschool period as being critical in the development of children's language and other cognitive abilities. Young children utilize language in order to perform the various cognitive and social tasks. Children who experience language difficulties may therefore be "at risk" to develop other problems. Consequently, it is important that any intelligence test provide some measure of the child's linguistic functioning.

In summary, several researchers (e.g., Bracken, 1985; Sternberg, 1984; Keith & Dunbar, 1984; Keith, 1985) have questioned the construct validity of the K-ABC, in particular the validity of the Sequential Processing Scale. The low correlations reported between the K-ABC Mental Processing Scales and other conventional intelligence tests (e.g., Hartnett & Fallendorf, 1983; Durham et al., 1984;
Bracken, 1983) in comparison to the higher correlations with the Achievement Scale has also been cited as a weakness. Lastly, the K-ABC has been criticized for its lack of an appropriate measure of linguistic functioning (e.g., Bracken, 1985; McCallum et al., 1985; Obzrut et al., 1984). It would be advantageous to examine the contribution or effect that language ability (i.e., receptive and expressive) has in the pattern of performance of exceptional preschool children on the K-ABC and to examine their overall level of performance relative to a more conventional measure. As noted in the previous discussion of the characteristics of preschool children, an examination of the role of language impairments in this population must be considered within the context of behavior problems, given the high degree to which these two factors are related (Beitchman et al., 1986; Stevenson et al., 1985; Baker & Cantwell, 1983).

Present study

The major goal of the present study was to examine the effects of language and behavior problems on level and pattern of performance on the K-ABC. For these purposes, children identified as experiencing a language impairment, on the basis of their performance on the Reynell Developmental Language Scales (Reynell, 1981) or Test for Auditory Comprehension of Language (Carrow, 1973), and/or behavior problems were compared to children without language and/or behavioral difficulties. Consequently,
three groups of exceptional children will be compared: 1) children with language impairment and no behavioral problems (LI), 2) children with language impairment and behavioral problems (LI-BP), and 3) children with behavior problems and no language impairment (BP). A comparison group of children not experiencing either behavior or language problems (COMP) was also included. In addition, the overall level of performance on the K-ABC of a portion of these children was compared to their performance on a more conventional IQ test. As noted in the review of preschool intelligence scales, the MSCA appears to be the most suitable measure with which to contrast the K-ABC.

It is apparent from the discussion above that several controversial issues focusing upon language have emerged in relation to the validity of the K-ABC. A number of researchers (e.g., Keith, 1985; Sternberg, 1984; Bracken, 1985) have questioned what the K-ABC actually measures. For example, there is some debate as to whether the Sequential Processing Scale assesses those abilities described in the Das-Luria model of information processing or verbal and verbal mediated memory as hypothesized by Keith (1985). The exclusion of language related measures from the intellectual scales has been cited as a particular weakness of the K-ABC in terms of identifying exceptional children (Naglieri, 1985a, 1985b; McCallum et al., 1985; Bracken, 1985). On the other hand, it has been suggested that this feature may be useful in assessing children with language disorders.
(Kaufman & Kaufman, 1983c; Telzrow, 1984). However, as was ascertained from the review of K-ABC validity studies, the minimal specific information available pertaining to the role of language functioning and K-ABC performance was confounded by the interaction of behavior difficulties and language delays (Klanderman, Wisehart, & Alter, 1983). In addition, various researchers (e.g., Jenkins et al., 1980; Baker & Cantwell, 1983; Stevenson et al., 1985; Beitchman et al., 1986) demonstrated that language delays and behavior problems constitute prevalent variables in the assessment of preschoolers "at risk" for poor academic adjustment, but little is known about the effects of these variables on assessment results.

The review of the literature has revealed that exceptional groups of school-age children (e.g., learning disabled and mentally retarded) may be differentiated on the basis of their Mental Processing Composite Scores (Naglieri, 1985a; Obzrut et al., 1984; Nelson, 1983). It has not yet been demonstrated that exceptional groups of preschoolers (e.g., children with language impairment or behavior disorders) may be similarly delineated.

On the basis of the discussion pertaining to the theoretical structure of the K-ABC, what pattern of performance might be predicted for children with a language learning disability? Kaufman and Kaufman (1983c) have emphasized the increased language demands of the Achievement Scale in contrast to the Mental Processing Scales.
Consequently, it may be inferred from Kaufman and Kaufman (1983c) that children with a language learning disorder would obtain higher scores on the latter scales in comparison to the former scale. In as much as the Achievement tasks require the synthesis of language (i.e., sequential processing), this pattern of performance would also concur with the prediction arising from the Das-Luria model. Given the factor structure of the K-ABC hypothesized by Keith (1985), language learning disabled children would be expected to exhibit lower performances on the Sequential (verbal mediated memory) and Achievement (verbal reasoning) Scales in comparison to the Simultaneous Scale (nonverbal reasoning).

It has been demonstrated that the K-ABC Achievement Scale is significantly correlated with language measures such as the PPVT-R (McCloughlin & Ellison, 1983). In addition, it has been suggested that preschool children with a language impairment exhibit a relatively superior performance on the Mental Processing Scales in comparison to their performance on the Achievement Scale (Telzrow, 1984). In contrast, Nelson (1983) reported that school age children with behavior problems did not exhibit a differential pattern of performance on the K-ABC Scales. Similarly, it was noted that preschoolers "at risk" for good kindergarten adjustment did not demonstrate a significant discrepancy between the K-ABC Scales.

In their discussion of the purposes and uses of the
K-ABC, Kaufman and Kaufman (1983c) have indicated that the organization of the K-ABC Scales also coincides with research on the Wechsler Scales involving children with learning disabilities. In this case, these children have been reported to demonstrate a strength in simultaneous processing and a weakness in sequential processing on the Wechsler Scales. Consequently, Kaufman and Kaufman (1983c) predicted that children who are experiencing learning difficulties should exhibit a relatively superior performance on the Simultaneous Processing Scale in comparison to the Sequential Processing Scale. In as much as linguistic deficits may be predictive of learning difficulties, as noted by Bryen and Gallagher (1983), it is important to determine if preschool children experiencing a language impairment might exhibit a comparable pattern of performance as those children with learning problems.

A similar pattern of performance would be predicted for children with language impairments from the Das-Luria model; and by Keith (1985), but for different reasons. If the Sequential Processing Scale is assessing those characteristics described by the Das-Luria model, including the complex processing of language, then children with a language disorder should have more difficulty on the sequential tasks as opposed to the simultaneous subtests. If the Sequential Scale assesses verbal and verbal mediated memory, while the Simultaneous Scale evaluates nonverbal functioning as proposed by Keith (1985), then a
similar pattern of performance would be expected for children with a language impairment.

Current research (e.g., Naglieri, 1985b; Obzrut et al., 1984; Kaufman & MacLean, 1986) focusing on school age children with learning disabilities has yielded conflicting results in relation to the sequential-simultaneous discrepancy. The lack of a differential pattern of performance on the Sequential versus Simultaneous Processing Scales has been attributed to the heterogeneity of those children with learning disabilities sampled. To date, there are no published studies examining the pattern of test performance for exceptional preschool children.

Virtually all research on the K-ABC with exceptional children has focused upon school age children (i.e., six to 12 1/2 years of age). It is equally important to determine if discriminative patterns of test performance can be identified in the preschool population. If so, can these patterns serve as a diagnostic aid in the identification of children "at risk"? Previous researchers (e.g., Kirk, 1972; Jordan et al., 1979; have demonstrated that intellectually handicapped children have benefited from early intervention programs that have resulted from preschool assessments.

From the description of the goals of the K-ABC, it is evident that the test was designed to minimize the role of verbal abilities and to limit the need for verbalization. One justification for this approach is that many preschool children, particularly those with a language impairment,
fail to comprehend the nature of the tasks on more traditional IQ tests. The K-ABC attempts to compensate for this difficulty by providing teaching items and allowing for the use of pantomime to communicate the concept of the task. The reduced language demands of the Mental Processing Scales may then allow for a more valid estimate of the intellectual functioning of children with a language impairment (Kaufman, 1984; Kaufman & Kaufman, 1983c). Consequently, it may be inferred from Kaufman and Kaufman (1983c) that children with a language impairment would be expected to obtain a higher overall Mental Processing Composite score on the K-ABC in contrast to their performance conventional intelligence tests.

Based on the above discussion, the following hypotheses were assessed in the present study.

**Hypothesis 1: Mental Processing Composite Scores and group differences**

Previous researchers have demonstrated that school age children may be differentiated on the basis of their performance on the Mental Processing Composite Scale. If this pattern is also present in preschool children, then the overall performance of children without a language impairment: Comparison (COMP) and Behavior Problem (BP), would be expected to exceed the performance of children with a language impairment: Language Impaired (LI) and Language Impaired with Behavior Problems (LI-BP).

**Hypothesis 2: Mental Processing Scales versus Achievement**
Scale differences

If the Mental Processing Scales are less dependent upon verbal and language skills, as stated by Kaufman and Kaufman (1983c), then children with a language impairment (i.e., LI and LI-BP) should perform in a superior manner on the Mental Processing Scales in comparison to their performance on the Achievement Scale. This pattern of results would also be anticipated in terms of the Das-Luria model, given that the Achievement Scale requires more complex language. However, based upon Keith’s (1985) model it would be predicted that the Sequential Processing and Achievement Scales would be lower than the Simultaneous Processing Scale for children with a language impairment. Such a differential pattern of performance would not be anticipated for either comparison or behavior problem children without language impairments.

Hypothesis 3: Sequential versus Simultaneous Scales

It is apparent from the review of the literature that research involving school age children with learning disabilities has yielded conflicting results regarding whether a significant Sequential-Simultaneous discrepancy is evident in this group of children. No data is available regarding the pattern of performance of learning impaired preschoolers on these scales; however, various researchers have suggested a differential pattern of performance might be expected in preschool children. It may be inferred from Kaufman and Kaufman (1983c) that a significant discrepancy would be predicted between the two processing scales on the
basis of previous research that has demonstrated that learning disabled children evidence poor sequential processing skills. While Keith (1985) and the Das-Luria model would also predict that the Simultaneous Processing Scale would be greater than the Sequential Processing Scale for children with a language impairment, this discrepancy would be attributed to different causes (i.e., the alternate factor structure of the K-ABC vs. complex sequential processing). Consequently, it is anticipated that children with a language impairment (i.e., LI & LI-BP) will exhibit a higher Simultaneous Processing Scale score than Sequential Processing Scale score. Such a discrepancy would not be anticipated for either the Comparison or Behavior Problem groups.

**Hypothesis 4: K-ABC Mental Processing Composite Scale versus the MSCA General Cognitive Index Scale**

Based upon the description and stated goals of the K-ABC, as well as the apparent differential language demands of the K-ABC and MSCA, it may be inferred from Kaufman and Kaufman (1983c) that children with language difficulties will exhibit different levels of performance between the two tests. It is anticipated children with a language impairment will obtain a higher overall score on the K-ABC Mental Processing Composite Scale than on the MSCA General Cognitive Index Scale. Such a difference would not be anticipated for either children with only behavior problems or children without language and behavioral difficulties.
Chapter Two

METHOD

Subjects

Data from the clinical records of 59 children, ranging in age from three-years four-months to six-years one-month (Mean Age = 4-8, SD = 8.7 months), were utilized in the present study. Twenty-three of these children were females (Mean Age = 4-7, SD = 9.6 months) and 36 were males (Mean Age = 4-9, SD = 8.1 months).

Of the 59 children, 46 attended the Day Treatment Program at The Child's Place, in Windsor, Ontario. The Child's Place is a diagnostic and treatment centre for preschool children and their families. Children serviced by the centre include those experiencing cognitive difficulties, speech and language delays, behavioral, and/or emotional problems. Children referred to the centre receive a Psychological Screening (e.g., The McCarthy Scales of Children's Abilities—short form), a speech and language evaluation, and a family assessment. The Day Treatment Program involves integration of these treatment children with seven "normative" children who have been identified through the same process of assessment as the treatment children. For the normative children, both the child and the family have been determined to be functioning within "normal" or adequate limits.

The remaining 13 children in this study were referred to, and assessed by, the Preschool Assessment Team at the Regional Children's Centre (R.C.C.), in Windsor, Ontario.
This team consists of a Psychologist, Speech and Language Pathologist, and Social Worker. The R.C.C. is a regional children's mental health centre which provides assessment and intervention services to children and their families in the Windsor tri-county area. The centre consists of a large comprehensive outpatient service which includes specialists from child care, neuropsychology, pediatrics, psychiatry, psychology, social work, and speech and language pathology. The centre provides court assessment services, intervention services for autistic children and their families, and a Day Treatment Program for pre-adolescent boys and girls, as well as Residential Treatment programs for adolescents. A percentage of those children who are assessed at the R.C.C. is suspected to be experiencing cognitive difficulties, speech and language delays, and/or behavioral problems.

Procedures

The K-ABC was administered to each participant by either a Child-Clinical Psychologist or graduate student enrolled in psychology. Standard administration and scoring procedures were followed, and children were seen individually in a quiet isolated room. Standard Scores for the five Global Scales of the K-ABC were computed for each child.

During the present study, The Child's Place was in transition from relying almost exclusively on the MSCA for cognitive assessment to relying more on the newer K-ABC, particularly for children with apparent language
difficulties. During this transition period, some children were given both tests in counterbalanced order within a time span of two weeks. MSCA scores were available for 37 of the 59 children in the present study sample.

Scores for the Reynell Developmental Language Scales and Test for Auditory Comprehension of Language (TACL) were obtained from each child's clinical record. These tests were administered by either a Speech and Language Pathologist or Speech Intern enrolled in graduate studies. Speech and language testing generally occurred within approximately two months of the administration of the K-ABC.

Each child was classified along two dimensions: 1) the presence or absence of a language impairment, and 2) the presence or absence of a behavior problem. Designation as language impaired was based upon the following criterion: a) that he/she obtain a receptive and/or expressive language score on the RDLS that was at least one standard deviation below the mean, or b) that the child receive a score on the TACL that was at least one standard deviation below the mean.

The designation of a child as experiencing a behavior problem was determined on the basis of the following criteria: a) Reason for referral (e.g., noncompliance, aggressiveness, temper tantrums, and impulsivity), b) a clinical formulation which verified the behavioral concerns (e.g., "The child's noncompliance and excessive level of activity are significantly interfering with his/her
development."), and/or c) information obtained from behavioral questionnaires (e.g., Achenbach Revised Child Behavior Profile, Eyeberg Child Behavior Inventory, and Minnesota Child Development Inventory). The children in the present study were classified along this dimension independently by the author and by a Clinical Psychologist. Interrater reliability for this classification was found to be 100%.

On the basis of the two sets of criteria, the children were categorized into four groups for the purpose of examining their test performance on the K-ABC. The comparison group (i.e., COMP) consisted of 15 children (five males and 10 females) who were not experiencing any language or behavior problems. In a previous study involving children from The Child's Place, it was found that the comparison group tends to score in the above average range (Morrison, 1986). Consequently, children were excluded from this group if their overall score fell outside the Average range (i.e., 85 to 115) at the 95% level of confidence (i.e., a Standard Error of Measurement of +/- 10 points). Seventeen children (10 males and seven females) were assigned to the group experiencing only behavior problems (i.e., BP group). The language impaired group without behavior problems (i.e., LI) consisted of 14 children (10 males and four females) while the language impaired group with behavior problems (i.e., LI-BP) contained 13 children (11 males and two females).
Measures

Intellectual. The K-ABC was described in Chapter One (see Figure 1). Briefly, five Global Scale Scores may be obtained from the K-ABC, three of which comprise the measure of intellectual functioning (i.e., Sequential Processing, Simultaneous Processing, and Mental Processing Composite). Each scale provides a Standard Score with a mean of 100 and a standard deviation of 15. Each of the Mental Processing subtests has a mean of 10 and a standard deviation of 3, while the Achievement subtests have a mean of 100 and standard deviation of 15.

The MSCA consists of 18 subtests grouped into six different scales: Verbal, Perceptual-Performance, Quantitative, Memory, Motor, and General Cognitive (see Figure 3). The first three scales are summated to determine the General Cognitive Scale which yields a General Cognitive Index Score with a mean of 100 and a standard deviation of 16.

Linguistic. The Reynell Developmental Language Scales were designed for use with children between the ages of one and seven. This test consists of two scales: the Verbal Comprehension Scale and the Expressive Language Scale. The first scale provides a measure of the child's understanding and is divided into 10 sections. These sections evaluate the child's understanding of such language processes as: verbal preconcepts, verbal labels, symbolic representation, and abstract reasoning. The latter scale consists of three
**McCarthy Scales of Children’s Abilities**

**General Cognitive Scale**

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<tr>
<th>Verbal Scale</th>
<th>Perceptual-Performance Scale</th>
<th>Quantitative Scale</th>
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<td>18. Conceptual Grouping</td>
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**Memory**

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<th>3. Pictorial Memory</th>
<th>9. Leg Coordination</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. Tapping Sequence</td>
<td>10. Arm Coordination</td>
</tr>
<tr>
<td>7. Verbal Memory</td>
<td>11. Imitative Action</td>
</tr>
</tbody>
</table>

**Motor**

<table>
<thead>
<tr>
<th>9. Leg Coordination</th>
</tr>
</thead>
<tbody>
<tr>
<td>10. Arm Coordination</td>
</tr>
<tr>
<td>11. Imitative Action</td>
</tr>
</tbody>
</table>

**Figure 3.** Grouping of the 18 McCarthy subtests into six scales.
sections and is concerned with the child's ability to name objects, to define words, and to describe or communicate ideas. Each Scale Score may be expressed as either a percentile score or age equivalent score.

The Test for Auditory Comprehension of Language (TACL) was designed to fulfill two functions: 1) to measure a child's auditory comprehension of language, and 2) to determine the specific areas of linguistic difficulties that a child may be experiencing. The test consists of 101 sets of line drawings arranged by grammatical category: 1) vocabulary, 2) morphology, and 3) syntax. Each item is associated with three pictorial choices which contribute to one of the three major categories. The TACL evaluates the child's understanding of both single words and sentences within each of the grammatical categories (Wiig & Semel, 1980).

In a study comparing the test performance of a group of children referred for speech therapy with that of a control group, correlation coefficients were reported between the TACL and RDLS Verbal Comprehension Scale and Expressive Language Scale of .99 and .71, respectively (Howell, Skinner, & Broomfield, 1981). For the purpose of the present study, a pilot investigation was conducted comparing the TACL and RDLS. The data was obtained from 51 consecutive admissions of preschoolers to The Child's Place for which these tests were available. Twenty-nine of these children had been referred for suspected language
difficulties and had received speech and language therapy, while the remaining 22 did not evidence any language delays. Correlation coefficients were obtained between the TACL and the RDLS Verbal Comprehension and Expressive Language Scales of .89 and .88, respectively. In addition, a multiple regression analysis was conducted to determine whether a child's performance on the TACL could be predicted from his/her performance on the RDLS (see Appendix A). The results indicated that a child's performance on either the RDLS Expressive Language Scale ($F(1,47) = 243.3, p < .01$) or the Verbal Comprehension Scale ($F(1,47) = 22.1, p < .01$) was significantly predictive of his/her performance on the TACL. Finally, the TACL and RDLS were compared in terms of their ability to differentially diagnose children as either language impaired or nonimpaired. The overall rate of agreement between the two tests exceeded 90%. Consequently, the use of the TACL and/or RDLS as a criterion for classifying children as language impaired is warranted in the present study.
Chapter Three

RESULTS

The major focus of the present study was to examine the effects of language and behavior problems on the assessment of preschool children using the K-ABC. In order to determine whether or not sex was a significant factor in the present study, the five Global Scales of the K-ABC were submitted to a three factor (Language, Behavior, and Sex) Multiple Regression analysis. The results of this analysis have been presented in Appendix B. Briefly, it was determined that the factor of Sex did not significantly contribute to the model as either a main effect or as part of an interaction (e.g., Language X Sex or Behavior X Sex). Consequently, sex as a factor was eliminated from the remainder of the analyses. The Means (M) and Standard Deviations (SD) for each of the five Global Scales by Group are presented graphically in Figure 4. Specific scores for each group are provided in Table 2.

Mental Processing Scales and group differences

It was hypothesized that differences would emerge in relation to children's performance on the Mental Processing Composite Scale of the K-ABC. It was expected that the performance of non language impaired children (i.e., COMP and BP) would exceed that of children identified as language impaired (i.e., LI and LI-BP). In order to evaluate the differences between the means for the Mental Processing Scales (i.e., Mental Processing Composite, Sequential Processing, and Simultaneous Processing Scales) a
Figure 4. Mean performance on each K-ABC Global Scale by Group

Note. MPC = Mental Processing Composite Scale
SEQ = Sequential Processing Scale
SIM = Simultaneous Processing Scale
ACH = Achievement Scale  NONVER = Nonverbal Scale
Table 2

Means and SDs of the K-ABC Global Scales by Group

<table>
<thead>
<tr>
<th>Global Scale</th>
<th>Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LI (n = 14)</td>
</tr>
<tr>
<td>Mental Processing Composite</td>
<td>83.1 9.7</td>
</tr>
<tr>
<td>Sequential Processing</td>
<td>86.1 11.4</td>
</tr>
<tr>
<td>Simultaneous Processing</td>
<td>84.6 12.2</td>
</tr>
<tr>
<td>Achievement Nonverbal</td>
<td>80.8 9.1</td>
</tr>
<tr>
<td></td>
<td>a n = 13</td>
</tr>
</tbody>
</table>

Note. LI = Language Impaired
LI-BP = Language Impaired with Behavior Problems
BP = Behavior Problem
COMP = Comparison
Multivariate Analysis of Variance (MANOVA) was conducted. The results of the MANOVA completed on the mean Mental Processing Scale Scores revealed significant main effects for language and behavior. The Hotelling-Lawley Trace Test (Spector, Goodnight, Sall, & Sarle, 1985) revealed an overall language effect ($F(3,53) = 15.60, p < .01$) and an overall behavior effect ($F(3,53) = 3.09, p < .05$). No significant language by behavior interaction was indicated by the results of the Hotelling-Lawley Trace Test ($F(3,53) = 1.17, p > .10$). Once the overall significance of the results was established, univariate ANOVAS for each Mental Processing Scale were examined to determine the nature of the mean differences.

Mental Processing Composite and group differences. The results of the univariate ANOVA (see Table 3) revealed that the main effect of Language was statistically reliable, indicating that the performance of children without language difficulties ($M = 99.4$, $SD = 12.5$) exceeded that of children with language difficulties ($M = 80.2$, $SD = 10.4$). The main effect of Behavior was also significant, indicating that the performance of children without behavior problems ($M = 93.9$, $SD = 15.9$) exceeded that of children with behavior problems ($M = 87.4$, $SD = 13.6$). The interaction effect of language by behavior was not statistically significant ($p > .10$).

Sequential Processing Scale and group differences. The analysis of Sequential Processing Scale scores (see Table 4) indicated that the main effect of language was significant.
Table 3

Univariate analysis of children's performance on the Mental Processing Composite scale as a function of language and behavior

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language</td>
<td>5597.47</td>
<td>1</td>
<td>5597.47</td>
<td>45.12**</td>
</tr>
<tr>
<td>Behavior</td>
<td>805.15</td>
<td>1</td>
<td>805.15</td>
<td>6.49*</td>
</tr>
<tr>
<td>Language by Behavior</td>
<td>23.99</td>
<td>1</td>
<td>23.99</td>
<td>0.19</td>
</tr>
<tr>
<td>Error</td>
<td>6823.24</td>
<td>55</td>
<td>124.06</td>
<td></td>
</tr>
</tbody>
</table>

* P < .05
** P < .01
Table 4

Univariate analysis of children's performance on the Sequential Processing scale as a function of language and behavior

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language</td>
<td>2936.80</td>
<td>1</td>
<td>2936.80</td>
<td>22.13**</td>
</tr>
<tr>
<td>Behavior</td>
<td>938.47</td>
<td>1</td>
<td>938.47</td>
<td>7.07**</td>
</tr>
<tr>
<td>Language by Behavior</td>
<td>3.40</td>
<td>1</td>
<td>3.40</td>
<td>0.03</td>
</tr>
<tr>
<td>Error</td>
<td>7300.20</td>
<td>55</td>
<td>132.70</td>
<td></td>
</tr>
</tbody>
</table>

**

P < .01
In this instance, children without language difficulties (M = 96.2, SD = 12.4) performed at a higher level than language impaired children (M = 82.4, SD = 11.6). This analysis also revealed a significant behavior main effect in which children without behavior problems (M = 93.7, SD = 14.4) exceeded those with behavior problems (M = 86.3, SD = 12.3) on the Sequential Processing Scale. No significant interaction effect was observed (p > .10).

Simultaneous Processing Scale and group differences. As in the case of the two preceding analyses (see Table 5), children without language difficulties (M = 102.2, SD = 12.0) obtained significantly greater Simultaneous Processing Scale scores than those children with language problems (M = 81.9, SD = 12.0). Similarly, the performance of children without behavior problems (M = 95.6, SD = 16.5) exceeded that of children with behavior difficulties (M = 90.3, SD = 14.7). No significant language by behavior interaction was evident (p > .10).

Mental Processing and Achievement Scale comparisons

Mental Processing Scales versus Achievement Scale. The mean scores reported in Table 2, and illustrated in Figure 4, were examined by group (i.e., LI, LI-BP, BP, & COMP) using single factor ANOVAS to evaluate the relationship between the Mental Processing Scales and the Achievement Scale. It had been hypothesized that children with a language impairment (i.e., LI & LI-BP) would perform in a superior manner on the Mental Processing Scales in
Table 5

Univariate analysis of children's performance on the Simultaneous Processing scale as a function of language and behavior

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language</td>
<td>6227.31</td>
<td>1</td>
<td>6227.31</td>
<td>45.01**</td>
</tr>
<tr>
<td>Behavior</td>
<td>564.95</td>
<td>1</td>
<td>564.95</td>
<td>4.08*</td>
</tr>
<tr>
<td>Language by Behavior</td>
<td>6.13</td>
<td>1</td>
<td>6.13</td>
<td>0.04</td>
</tr>
<tr>
<td>Error</td>
<td>7609.16</td>
<td>55</td>
<td>138.30</td>
<td></td>
</tr>
</tbody>
</table>

* \( p < .05 \)

** \( p < .01 \)
comparison to their performance on the Achievement Scale. Such a differential pattern of performance was not anticipated for either the behavior problems or comparison children.

The hypothesis of significant differences between the Global Scales for language impaired children was not supported. No significant difference was noted in the overall performance of language impaired children without behavior problems, between the various scales ($F(3, 38) = 0.93, p > .10$). While the LI children obtained overall means on the Mental Processing Composite ($M = 83.1$), Sequential Processing ($M = 86.1$), and Simultaneous Processing ($M = 84.6$) Scales that exceeded their Achievement mean ($M = 80.8$), these differences were not reliable. Relative to their scores on the Achievement Scale, six of 13 LI children obtained higher Mental Processing Composite scores, four obtained higher Sequential Processing scores, and eight earned higher Simultaneous Processing scores. The Scale scores for individual children are presented in Appendix C.

Similarly, no overall significant differences were obtained for language impaired children with behavior problems ($F(3, 35) = 0.57, p > .10$). Although these children achieved overall means on the Mental Processing Composite ($M = 77.0$), Sequential Processing ($M = 78.5$), and Simultaneous Processing ($M = 79.0$) Scales that exceeded their Achievement Scale performance ($M = 76.0$), these
differences were not statistically reliable (p > .10). In comparison to their performance on the Achievement Scale, five of the LI-BP children obtained a higher Mental Processing Composite score, while eight earned higher Sequential Processing and Simultaneous Processing scores.

The analysis of mean differences between the Mental Processing Scales for the Behavior Problem group (i.e., BP) indicated a significant overall effect (F (3,48) = 4.95, p < .01). Consequently, a post hoc analysis (i.e., Newman-Keuls) was completed to examine the nature of these differences. While the BP group obtained Mental Processing Composite (M = 95.3) and Sequential Processing (M = 92.2) scores that were greater than their Achievement Scale (M = 90.6) score, these differences were not significant (p > .10). However, the overall performance of BP children on the Simultaneous Processing Scale (M = 99.0) was significantly greater than their performance on the Achievement Scale (p < .01). In relation to their performance on the Achievement Scale, 15 of 17 children obtained a greater Simultaneous Processing score, while 12 children earned higher Mental Processing Composite scores, and nine obtained greater Sequential Processing scores.

As was anticipated, no significant overall differences were evident for Comparison children in terms of their performance on the Mental Processing and Achievement Scales (F (3,41) = 1.84, p > .10). In this instance, five of 14 children obtained higher Mental Processing Composite and
Sequential Processing scores in contrast to their Achievement scores, while six achieved higher Simultaneous Processing scores.

**Sequential Processing versus Simultaneous Processing Scale.** It had been anticipated that children with language difficulties (i.e., LI & LI-BP) would exhibit a higher level of performance on the Simultaneous Processing Scale in comparison to their Sequential Processing performance. Such a difference was not anticipated for either the Comparison or Behavior Problem groups. These predictions were examined as part of the single factor ANOVAs reported in the preceding sections.

The analyses revealed that neither group of language impaired children (i.e., LI & LI-BP) exhibited a significant Sequential-Simultaneous Processing discrepancy ($p > .10$). Although a difference was noted between the Sequential Processing Scale ($M = 86.1$) and Simultaneous Processing Scale ($M = 84.6$) for the LI children, it was not statistically reliable ($p > .10$). Only six of 14 children displayed a Simultaneous Processing score that was greater than their Sequential Processing score. The pattern was reversed for LI-BP children, in that their Simultaneous Processing score ($M = 79.0$) exceeded their Sequential Processing score ($M = 78.5$), however this difference was not significant ($p > .10$). In this case, six of 13 children obtained a higher Simultaneous Processing score than Sequential Processing score.
As indicated previously, a significant overall effect was reported in the mean Global Scale scores for the Behavior Problem group ($p < .01$). The Newman-Keuls test for differences between the means indicated that their Simultaneous Processing score ($M = 99.0$) was statistically greater than their mean Sequential Processing score (92.3). In this case, 12 of the 17 BP children obtained a Simultaneous Processing Scale Score that was greater than their Sequential Processing score.

As expected, the Comparison group did not exhibit a significant difference between their Simultaneous Processing score ($M = 105.9$) and Sequential Processing score ($M = 100.7$). In this instance, nine of the 15 children earned greater Simultaneous Processing than Sequential Processing Scale scores.

**K-ABC Mental Processing Composite Scale versus MSCA General Cognitive Index Scale**

As indicated in the procedure section, a subset of the children in the present study received a MSCA in addition to the K-ABC. Children with language impairments (i.e., LI & LI-BP) were combined to form one group due to the small number for which MSCA scores were available. For the purpose of comparison of the two tests, children were assigned to one of three groups; those children with language impairments (LI/LI-BP, $n = 12$); those children with only behavior problems (BP, $n = 11$); and those children with neither language nor behavior problems (COMP, $n = 14$).
Differences between the two scale scores for each group were examined using t-tests for differences between correlated samples.

The hypothesis that children with a language impairment would obtain a greater Mental Processing Composite score than General Cognitive Index score was confirmed (see Table 6). In this case, the combined language impaired group obtained a Mental Processing Composite Score (M = 79.17) that was significantly higher than their General Cognitive Index Score (M = 64.75), p < .01. In all, nine of the 12 combined language impaired group obtained Mental Processing Composite scores that were higher than their General Cognitive Index scores and two earned equal scores. The differences noted between the two Scales for both the COMP and BP children were not statistically reliable (p > .10). In this case, six of 14 COMP children and seven of 11 BP children earned greater Mental Processing Composite than General Cognitive Index scores. The relationship between these scores for the three groups of children has been illustrated in Figure 5.

Summary

The results of the analyses conducted on the mean Mental Processing Composite, Sequential Processing and Simultaneous Processing Scale Scores revealed significant main effects for both language and behavior, while the interaction effect was not statistically reliable. Children without language impairments obtained scores that were
Table 6

Mean differences, t scores, and overall means for the comparison between the K-ABC Mental Processing Composite Score and the MSCA General Cognitive Index Score for Comparison, Behavior Problem, and Combined Language Impaired children

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean Difference</th>
<th>T</th>
<th>MPC (SD)</th>
<th>GCI (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMP (n = 14)</td>
<td>0.71</td>
<td>-0.28</td>
<td>103.14 (13.1)</td>
<td>103.85 (16.9)</td>
</tr>
<tr>
<td>BP (n = 11)</td>
<td>3.36</td>
<td>1.26</td>
<td>95.63 (10.0)</td>
<td>92.18 (9.6)</td>
</tr>
<tr>
<td>LI/LI-BP (n = 12)</td>
<td>14.42</td>
<td>3.29*</td>
<td>79.17 (9.9)</td>
<td>64.75 (19.4)</td>
</tr>
</tbody>
</table>

* \( p < .01 \)

Note. COMP = Comparison
      BP = Behavior Problem
      LI/LI-BP = Combined Language Impaired

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Figure 5. Relationship between the mean K-ABC Mental Processing Composite scores and MSCA General Cognitive Index scores for COMP, BP, and combined LI/LI-BP children

Note. COMP = Comparison BP = Behavior Problem LI/LI-BP = Combined Language Impaired

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greater than those children who were language impaired. Similarly, those children without behavior problems performed at a higher level than those children with behavioral difficulties.

Furthermore, the analyses performed revealed that the language impaired groups (i.e., LI & LI-BP) did not demonstrate a differential pattern of performance on any of the Mental Processing Scales in comparison to their Achievement Scale performance. While these children obtained overall means scores on the Mental Processing Composite, Sequential Processing, and Simultaneous Processing Scales that were two to four points higher than their score on the Achievement Scale, these differences were not significant ($p > .10$). It was noted that the Comparison group also obtained Mental Processing Composite and Simultaneous Processing scores that were four to five points higher than their Achievement score, although their performance on the Sequential Processing was more or less comparable. Only the Behavior Problem group demonstrated a significant discrepancy in their performance on the Mental Processing Scales in comparison to their Achievement Scale. While the mean Mental Processing scores were two to nine points greater than the Achievement Scale, only their performance on the Simultaneous Processing Scale was significantly greater than that on the Achievement Scale ($p < .01$).

The comparison of Sequential Processing and
Simultaneous Processing Scale performances in the language impaired groups (i.e., LI & LI-BP) revealed that equal proportions of children obtained either a higher Sequential Processing or Simultaneous Processing score. Similarly, Comparison children did not display a differential pattern of performance on the Sequential Processing versus Simultaneous Processing scales. In contrast, Behavior Problem children clearly demonstrated a significant discrepancy between the two scales in favour of the Simultaneous Processing scale.

The comparison of Mental Processing Composite and General Cognitive Index scores for the combined group of language impaired children (i.e., LI/LI-BP) revealed that they obtained a significantly greater overall score on the K-ABC in comparison to the MSCA. As expected, neither the Comparison nor Behavior Problem children exhibited a significant discrepancy between their performances on the two Scales.
Chapter IV
DISCUSSION

The purpose of the present study was to investigate the effects of language and behavior problems on preschoolers’ performance on the K-ABC. For this purpose, children identified as experiencing a language impairment and/or behavior problems were compared to children who were not experiencing any language and/or behavioral difficulties. Two aspects of children’s performance on the K-ABC examined: 1) their overall level of performance on the K-ABC in contrast to the MSCA, and 2) their pattern of performance on the K-ABC Mental Processing and Achievement Scales. The following discussion will focus on the significance of the obtained results as they relate to the present study and as they pertain to the use of the K-ABC with exceptional preschool children. In addition, suggestions will be advanced concerning future research in preschool assessment using the K-ABC.

One of the goals in developing the K-ABC was to facilitate the assessment of exceptional preschool children, particularly those experiencing a language impairment. The superior performance of children with language impairments on the Mental Processing Composite Scale of the K-ABC in contrast to the General Cognitive Index Score of the MSCA, clearly confirmed the hypothesis that the K-ABC provides a higher estimate of the child’s level of functioning. The finding that neither the Comparison nor Behavior Problem groups exhibited significant discrepancies in their
performance on the two tests is consistent with findings reported in the literature for both school age and preschool age children (e.g., Nelson, 1983; Klanderman, Wisehart, & Alter, 1983; Hartnett & Fallendorf, 1983; Bracken, 1983).

The results of the comparison of the K-ABC and MSCA suggest that the K-ABC may facilitate the assessment of preschool children with a language impairment. Some degree of caution concerning the generalizability of these results is warranted given the small sample size examined. However, a paradox exists in that many children with language impairments cannot perform on more conventional measures of intelligence because of the increased language demands, thereby making it difficult to obtain comparisons between the K-ABC and other IQ tests. The results also suggest that the K-ABC and MSCA may be utilized interchangeably in the assessment of young children with behavior problems.

The hypothesis that children with language impairments and/or behavior problems would be differentiated from those children without such difficulties on the basis of their overall performance on the K-ABC was confirmed. Clearly, those children experiencing either a language impairment and/or behavior problem obtained lower Global Scale scores than the Comparison children. Interestingly, the presence of both a language impairment and behavior problem did not interact to produce significantly lower Global Scale scores for those language impaired children with behavior problems in comparison to children with only language impairments.
The performances of children on the K-ABC were differentiated on the basis of the presence or absence of a language impairment or behavior problem. However, the findings lacked the specificity necessary for classification purposes in that each group showed a similar pattern of impairment on the Mental Processing Scales and Achievement Scale in contrast to the Comparison children. In addition, the results revealed that children with language impairments did not exhibit any discrepancies between their various Scale Scores. The lack of a differential pattern of performance for these children is contrary to what was anticipated on the basis of the theoretical models presented in the Introduction. Noteworthy is the finding that Behavior Problem children demonstrated an unexpected differential pattern of performance in which their Simultaneous Processing scores were significantly greater than both their Sequential Processing and Achievement Scale Scores. The meaning and diagnostic significance of these results will be explored further in the context of the K-ABC's theoretical framework.

The expectation that children with a language impairment would exhibit discrepancies between their Mental Processing Scales and Achievement Scale scores was based on implications derived from the Das-Luria model of information processing, Keith's (1985) alternate factor structure for the K-ABC, and Kaufman and Kaufman's (1983c) description of the Global Scales, as well as empirical evidence.
Basically, the presence of a discrepancy between these scales could be attributed to differential reliance on language skills by each scale and/or differential reliance on cognitive processing modes. What factors then may have contributed to the lack of a differential pattern of performance for those children with a language impairment?

A criticism of the K-ABC has been that it does not provide a procedure for determining the type of strategy utilized by the child to perform a given task (Das, 1984a). The subtests are assigned to one of two categories (i.e., sequential or simultaneous) on an _a priori_ basis. Although a differential pattern of performance might be expected for children with a language impairment in contrast to Comparison children, it might not be possible to evaluate this hypothesis using the K-ABC. Das (1984a; 1984b) has argued that it is not necessary that children utilize sequential strategies to complete "sequential" tasks nor use simultaneous strategies to complete "simultaneous" tasks. In research involving children experiencing mental retardation or learning disabilities, Das et al. (1979) reported that these children may employ sequential and simultaneous processes differently in solving more complex tasks relative to non-impaired children. In addition, it has been suggested that the failure to obtain a Sequential-Simultaneous discrepancy in school age children with learning disabilities is due to their inability to utilize simultaneous and sequential processes in an optimal
manner (Naglieri, 1985b). Consequently, the lack of a discrepancy between the Sequential Processing and Simultaneous Processing Scales for children with language difficulties might be attributed to their inability to efficiently employ or appropriately utilize either processing strategy.

Contributing to the question of strategy utilization is the issue of the development of the two mental processes. It has been suggested that there is a gradual age-related differentiation of sequential and simultaneous processing from a more global general ability (Kamphaus & Kaufman, in press). For example, Das (Das, 1984a; Das et al., 1979) has suggested that successive processes may develop earlier than simultaneous processes. If so, a lower performance on the Simultaneous Processing Scale may be anticipated at early age levels (i.e., preschool) thereby reducing the magnitude of differences between the Sequential Processing and Simultaneous Processing Scales. While the factor analytic studies reviewed previously have demonstrated that the sequential subtests loaded on the Sequential Processing Scale and the simultaneous tasks loaded on the Simultaneous Processing Scale for groups of normal children, does this occur for groups of exceptional children, particularly preschoolers? Those factor studies employing referred school age children have confirmed the factor pattern of the K-ABC (Keith, 1986; Kaufman & McLean, 1986). However, no comparable studies of referred preschool children have been
conducted to suggest that the factor structure of the K-ABC is similar for these children.

One possible explanation for the lack of differential pattern of performance for those children with language impairments emerges from the preceding discussion. Consider the hypothesis that the two mental processes develop from a global ability in an age-related fashion. Research thus far has demonstrated that the two factors are present in children at three to four years of age (Willson et al., 1985; Kamphaus & Kaufman, in press). It has been emphasized that language plays a central role in the development of preschool age children (Bryen & Gallagher, 1983). Children who are experiencing delays or deficits in their language abilities may be considered to be exhibiting developmental delays. It is entirely possible then that these children are also experiencing delays in the development, differentiation, and appropriate utilization of the two mental processes. Therefore, consistent discrepancies between the Sequential Processing and Simultaneous Processing Scales may be less likely to emerge.

As noted, the comparison of Sequential Processing and Simultaneous Processing Scale performances in the language impaired groups (i.e., LI & LI-BP) revealed that equal proportions of children obtained either a higher Sequential Processing or higher Simultaneous Processing score.

The lack of a discrepancy between the Mental Processing Scales and the Achievement Scale may also be understood.
within this framework. While the Achievement Scale is separated from the Mental Processing Scales, it is also dependent upon sequential and simultaneous processes in addition to acquired abilities (Kaufman & Kaufman, 1983c). For example, the Riddles subtest has been shown to require simultaneous processing while the Arithmetic subtest utilizes sequential skills (Kaufman, 1984). In fact, the Achievement Scale is significantly correlated ($r < .05$) with the the Sequential Processing ($r = .46$), Simultaneous Processing ($r = .64$), and Mental Processing Composite ($r = .66$) Scales at the preschool level. The failure to observe a discrepancy between these scales may also be attributable to deficits in the two mental processes.

While deficits in the two mental processes may account, in part, for the lack of discrepancy between the Achievement Scale and Mental Processing Scales, this finding may also be understood in relation to the nature of the Achievement Scale itself. In the Interpretive Manual, Kaufman and Kaufman (1983c) emphasize that the Achievement Scale assesses knowledge and skills that are obtained through education and everyday learning experiences. One of the main goals of the Achievement Scale is to evaluate the child's current level of "academic accomplishment" and to predict school performance (Kaufman & Kaufman, 1983c). In examining the content of the Achievement subtests at the school age level, it is readily apparent that these items fulfill this goal. However, it is difficult to determine
what the Achievement Scale is measuring for preschool children. At the school age level most children have all been exposed to the type of information assessed by the Achievement Scale in their day to day school routines. These children therefore share a common experience on which they can be evaluated and compared. The experiences of preschool children, however, are more diverse. Some children may be enrolled in an enriched preschool program which emphasizes pre-academic skills, others may be involved in a day care on a custodial basis, while still others are cared for at home. The lack of a common experience for preschool children increases the difficulty in assessing achievement. Consequently, the items found on the Achievement Scale may not be as sensitive to linguistic deficits as initially hypothesized, thereby reducing the sensitivity of this Scale to such difficulties.

Thus far, the failure to observe significant discrepancies between the various scales has been examined within the context of processing and language deficits. A second possibility may explain the observed results. The review of the literature pertaining to school age children with learning disabilities has yielded conflicting results in relation to the sequential-simultaneous discrepancy. The lack of discrepancies between the Global Scales has been attributed to the possible heterogeneity of the samples examined (Kaufman, 1984; Kaufman & Kaufman, 1983c; Naglieri, 1985b). The question then arises as to whether or not
children with language impairments represent a heterogeneous group.

In describing children with language disorders, Richman and Eliason (1983) have suggested that these children display a differential pattern of strengths and weaknesses in associative learning and memory functions. These authors have categorized children with language difficulties as possessing either: 1) good associative reasoning and poor sequencing-memory, or 2) good sequencing-memory and poor associative reasoning. It has been argued that the Mental Processing subtests, specifically the sequential tasks, rely too heavily upon short term memory (Sternberg, 1984; Bracken, 1985; Das, 1984a; Goetz & Hall, 1984). The alternate factor structure described by Keith (1985) conceptualizes the Sequential Processing scale as requiring verbal memory and the Simultaneous Processing and Achievement Scales as requiring nonverbal and verbal reasoning, respectively. It would follow then, that those children with a language disorder meeting the criterion for type 1 would demonstrate a superior performance on the Simultaneous Processing Scale in comparison to the Sequential Processing Scale. In contrast, type 2 children would exhibit the reverse pattern of performance.

Can the lack of a significant discrepancy between the Sequential Processing and Simultaneous Processing Scales for children with a language impairment be attributed to the possible heterogeneity of the children sampled? As
indicated in the results, a relatively equal proportion of LI and LI-BP children obtained either a higher Sequential Processing or Simultaneous Processing Scale score thus lending some support to the notion of heterogeneity. The further examination of the Mental Processing scores found in Appendix C, however, refutes this hypothesis. While 11% of the children demonstrated a significant Sequential-Simultaneous discrepancy in favour of the Sequential Processing Scale and 19% in favour of the Simultaneous Scale, 70% of the LI and LI-BP children did not exhibit such discrepancies. It is unlikely that the lack of a Sequential-Simultaneous discrepancy was a function of the lack of homogeneity of the children examined in the present study. If anything, the results indicate that language impaired children may exhibit both associative learning and memory deficits at least at the preschool level.

A third, and perhaps the most parsimonious, explanation for the lack of significant discrepancies between the K-ABC Scale scores for children with language impairments centers upon the issue of intellectual development of preschool children. It is evident from the literature review in the introduction, that a number of theorists and researchers consider language to be intrinsically related to intelligence (e.g., Bracken, 1985; Sternberg, 1984; Naglieri, 1985a; Obzrut et al., 1984). The preschool years are generally considered to be the most important developmentally since much of the groundwork for the
acquisition of more complex behaviors is established at this time (Schroeder et al., 1983). A cornerstone to this development is the emergence and growth of language abilities. Many of the skills a child acquires at this time are accomplished through the process of communication. Consequently, difficulties in a child's linguistic abilities not only affect his/her language development, but also the acquisition and development of other skills and abilities.

Given the critical role that language plays in development, it is entirely possible that the presence of a language impairment may be more indicative of a general intellectual delay rather than a specific language learning disability, at least at the preschool level. If preschool children who are identified as experiencing language difficulties may also be demonstrating more global deficits, then a differential pattern of performance might not be anticipated on the K-ABC. The results of the present study suggest that it may not be possible to make a differential diagnosis between a language disability and a more general intellectual delay at the preschool level, solely on the basis of the K-ABC test results. The K-ABC may be used in conjunction with, for example, the Vineland Adaptive Behavior Scales (Sparrow, Balla, & Cicchetti, 1984) as a means of differentiating between children with a language impairment and those with general developmental delays. In this case, impaired scores in the four subdomains (i.e.,
Communication, Socialization, Daily Living Skills, and Motor Skills) in conjunction with similarly low K-ABC scores would be consistent with global developmental delays. In contrast, if language skills assessed by the Communication subdomain were significantly impaired relative to the other subdomains, and the K-ABC was low, a specific language delay would be more likely. A second alternative would be to evaluate the K-ABC results within the context of a neuropsychological battery.

The discussion thus far has focused on the meaning of the results as they pertain to children with language difficulties. Equally important is the significance of the present findings relative to children with behavior problems. As stated previously, BP children demonstrated a differential pattern of performance in that they obtained a Simultaneous Processing Scale score that was significantly greater than either their Sequential Processing Scale score or Achievement Scale score. Interestingly, this test pattern was predicted for children with a language impairment. Children in the BP group were selected in part on the basis of average performance on either the Reynell Developmental Language Scale or Test for Auditory Comprehension of Language. Therefore, their performance on the K-ABC cannot be attributed to language difficulties. What factors did contribute to their pattern of test performance?

The results of joint factor analyses of the K-ABC and
WISC-R in both normal and learning disabled school age populations have indicated that the Sequential Processing Scale closely resembles the Freedom from Distractibility (FD) factor for the WISC-R (Kaufman & McLean, 1985; 1986). The FD factor involves those WISC-R subtests which are most vulnerable to distractibility, such as Arithmetic, Digit Span, and Coding (Lutey, 1981). All three Sequential Processing Scale subtests (i.e., Hand Movements, Number Recall, and Word Order) loaded significantly on the joint Sequential/Distractibility factor (Kaufman & McLean, 1985; 1986). Children with behavior problems are often characterized by their distractibility and difficulties in attending. Given the relationship between the Sequential Processing Scale and the FD factor, the lower performance of BP children on the Sequential Processing Scale in comparison to the Simultaneous Processing Scale may reflect the concentration difficulties of these children.

A similar argument may be made for the performance of BP children on the Achievement Scale relative to the Simultaneous Processing Scale. As indicated previously, successful performance on the Achievement Scale is not only dependent upon specific learned abilities, but also on the two types of processing. Bracken (1985) has argued that with the exception of the Riddles subtest, the remaining achievement tasks depend largely on rote memory. Factor analytic studies (e.g., Kaufman & Kamphaus, 1984; Kaufman & McLean, 1985; 1986) have revealed that several of the
achievement subtests utilize sequential processing (i.e., Arithmetic and Riddles) at the preschool level. While these subtests have loaded primarily on the achievement factor, they have been demonstrated to be significantly correlated with the FD factor ($r = 0.39, p < .05$) as well (Kaufman & McLean, 1986). Consequently, children experiencing attentional difficulties, such as the BP children, would likely exhibit discrepancies in their performance on the Achievement Scale in relation to those tasks that are less effected by distractibility (i.e., Simultaneous Processing Scale).

What is evident from the test results of the BP children is that their relatively poor performance on the Sequential and Achievement Scales may be indicative of difficulties that are independent of their level of intellectual functioning. At present it is difficult to determine the degree to which such factors as attention and distractibility contributed to their overall test performance. What the results do suggest, though, is that some caution is warranted in interpreting the K-ABC Global Scale scores of BP children.

Concluding remarks

What can be said of the performance of exceptional groups of preschoolers on the K-ABC? The present findings suggest that the K-ABC may provide more information than conventional measures of intelligence in the assessment of preschool children with language impairments, in that these
overall level of performance on the K-ABC in comparison to the MSCA. In addition, it was revealed that children with language impairments or behavior problems exhibited performances on the K-ABC Global Scales that differentiated them from a group of comparison children. These results are consistent with findings that support the K-ABC's ability to identify exceptional school age children (e.g., Naglieri, 1985a; Obzrut et al., 1984).

The overall performances of children were differentiated on the basis of the presence or absence of a language impairment or behavior problem. The lack of a distinctive K-ABC profile for children with language impairments (i.e., a Sequential-Simultaneous discrepancy) contradicted predictions based upon the theoretical models presented in the Introduction, such as the Das-Luria model of information processing, Cattell's model of fluid and crystallized intelligence, and Keith's (1985) alternate factor structure. Several explanations were presented to account for the lack of a distinctive pattern of Global Scale scores. It was suggested that the performance of preschool children with a language impairment may be indicative of an inability to effectively utilize the two processing strategies; a delay in the emergence of these cognitive processes; or more global developmental delays. It was recommended that the K-ABC be used in conjunction with a measure of adaptive behavior or as part of a comprehensive neuropsychological test battery in order to
differentiate a language impairment from a more general developmental delay or processing deficit.

The results suggest that the test performance of children, particularly those with behavior problems, may be effected by variables unrelated to cognitive functioning. For example, the test performance of BP children was comparable to the pattern hypothesized for children with language impairments. However, these results were likely attributable to attentional difficulties rather than specific processing deficits or linguistic skills.

As indicated in the Introduction, there are few well standardized measures of intelligence for preschool children. Consequently, it is important that we increase our understanding of the K-ABC, especially as it pertains to preschool children. On the basis of the findings of the present study, several areas for future research are apparent. As noted in the discussion, one explanation for the lack of a distinctive pattern of performance for children with language impairments is possible delays in the development, differentiation, and appropriate utilization of the two mental processes. This represents an important area of study, especially given the paucity of research with preschool children and the K-ABC.

It has been suggested that the scores obtained from the Mental Processing Scales and Achievement Scale may be too global in nature to reveal a differential pattern of performance for exceptional children (Kaufman, 1984; Kaufman

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& Kaufman, 1983c). The findings of the present study support this hypothesis in that no specific pattern of Global Scale scores was evident for children with a language impairment. A second area of study might address the question of whether or not both preschool and school age children with a language impairment exhibit a specific pattern of subtest performance.
Appendix A

Source Table for Multiple Regression Analysis of the
Reynell Developmental Language Scales and Test for Auditory
Comprehension of Language

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Table A

Analysis of the Reynell Developmental Language Scales as a predictor of children's performance on the Test for Auditory Comprehension of Language

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* *p < .01

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Appendix B

Source Tables for Multiple Regression Analyses of the K-ABC Global Scales as a function of Sex
### Table B

**Analysis of children's performance on the Mental Processing Composite Scale as a function of language, behavior, and sex**

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* $p < .05$

** $p < .01$
Table C

Analysis of children's performance on the Sequential Processing Scale as a function of language, behavior, and sex

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*  \( p < .05 \)

** \( p < .01 \)
Table D

Analysis of children’s performance on the Simultaneous Processing Scale as a function of language, behavior, and sex

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*  \( p < .05 \)

**  \( p < .01 \)
Table E

Analysis of children's performance on the Achievement Scale as a function of language, behavior, and sex

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* \( p < .05 \)

** \( p < .01 \)
Table F

Analysis of children's performance on the Nonverbal Scale as a function of language, behavior, and sex

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* \( P < .05 \)

** \( P < .01 \)

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Appendix C

Raw Data
Table G

K-ABC Global Scales, HSCA GCI, and RDLS scores for children by group

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<th>NON-VER</th>
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**Comparison**

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**Language Impaired**

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**Note.** Scores for the Expressive Language (EL) and Verbal Comprehension (VC) scales of the Reynell Developmental Language Scales (RDLS) are reported as Standard ‘Z’ Scores. Subjects for whom there are no RDLS scores received a Standard Score ranging from -1.5 to -1.8 on the Test for Auditory Comprehension of Language.
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