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COMPARISON OF CHC FACTORS IN THE WOODCOCK JOHNSON-III AND THE KAUFMAN ASSESSMENT BATTERY FOR CHILDREN-II

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COMPARISON OF CHC FACTORS IN THE WOODCOCK JOHNSON-III AND THE KAUFMAN ASSESSMENT BATTERY FOR CHILDREN-II

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ABSTRACT

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Assessments such as the Woodcock Johnson III, Tests of Cognitive Abilities (WJ III COG) and the Kaufman Assessment for Children-II (KABC-II) are administered by practitioners in order to determine eligibility for special education. The WJ III, COG is based on the Cattell-Horn-Carroll (CHC) theory of cognitive abilities and the KABC-II is grounded in the CHC theory and Luria's neuropsychological theory of processing. This study focused on how the CHC components and the global scores of the WJ III COG and the KABC –II related to one another and how the global scores on the KABC-II differed from one another. Thirty students identified with specific learning disabilities (SLD) were administered both tests. Data was analyzed using a paired-sample t test and the CHC factors from the tests were correlated. The results showed no significant differences between the mean of students' global scores and no significant difference between the global scores. The subtests measuring the same CHC factors showed 24 significant correlations. These findings suggest that the scores representing each CHC factor may not be interpreted in isolation for students with SLD. Cognitive processing deficits and variance displayed by students with SLD could impact the interpretation of these factors.

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CHAPTER I

INTRODUCTION

Statement of the Problem

The National Association of School Psychologists'(NASP) training standards require school psychologists to collect data, translate assessment results and evaluate outcomes of service using empirically supported information (NASP, 2002). As a result, school psychologists use standardized tests to assess students' intellectual abilities, academic achievements and behaviors within the school setting in order to make appropriate accommodations for them within the classroom (Andrews, Saklofske & Janzen, 2001). Additionally, research has shown that school psychologists report spending half of their time in psychoeducational assessment activities (Hall, Claxton, Jones, Clayton, Warnick & Daniels, 2007; Reschly & Wilson, 1995).

Standardized assessments, such as intellectual scales, are administered to help predict a student's future academic performance and to identify students with special abilities and/or learning problems (Mather & Roberts, 1994; Sattler, 2001). The most common reason for administering individual intellectual scales is to obtain information which may be used to determine a student's eligibility for special education services, in accordance with most state special education guidelines (Kranzler, 1997). In fact, ninety-eight percent of states include the concept of a severe discrepancy between IQ scores and achievement scores in their classification definitions of a learning disability (Flanagan & Ortiz, 2001; Mather & Roberts, 1994). Therefore, it is important for an assessment tool to be based on an empirically supported theory in order for practitioners to link assessment results to appropriate intervention planning (Andrews et al., 2001). Furthermore, when theory is not applied to assessment and instruction, school psychology practice becomes potentially unsound (Flanagan & Ortiz, 2001).

A shift toward theory based intellectual scales began in the 1980s with the introduction of the Kaufman Assessment Battery for Children, the revisions of the Stanford-Binet and the Woodcock-Johnson Tests of Cognitive Abilities-Revised (Kaufman, 2000). Given this shift, many theories defining intelligence have been developed and analyzed. Additionally, as these theories have taken hold, many researchers have created and revised appropriate intellectual measures to guide intervention and instruction, particularly in educational settings. Such theories can be categorized as either quantitative or qualitative in nature (Tupper, 1999). Quantitative theories are derived from psychometric practices, while qualitative theories are derived from analysis of individual, clinical cases (Tupper).

One such quantitative theory proposed by McGrew (1997) is known as the Cattell-Horn-Carroll or CHC theory (Schrank, Flanagan, Woodcock, & Mascolo, 2002). This theory is an expansion and extension of most of the previously devised theories of cognitive abilities, in particular, those of Spearman, Thurstone, Vernon, Horn and Cattell, Hakstian and Cattell and Fustafsson (Carroll, 1997). This comprehensive theory includes ten broad abilities and has been identified as “the most comprehensive and empirically supported model of the structure of intelligence currently available." (Flanagan and McGrew, 1997, p. 315; Flanagan & Ortiz, 2001).

Another, more qualitative theory of intelligence is Luria's neuropsychological theory of processing (Languis & Miller, 1992). Luria's goal was to map out the brain's systems and functions responsible for the high-level processes associated with learning, information processing and problem-solving abilities (Kaufman & Kaufman, 2004). Luria's theory suggests that the brain is composed of three units/blocks of processing which contributes to one's overall performance (Languis & Miller, Luria,1973).

Given these two empirically based theories of intelligence, intellectual scale developers are faced with a challenge of how to measure the components identified within these theories. Quantitative measures include the use of standardized tests/procedures, while qualitative measures are more flexible and may include observations and interviews (Tupper, 1999).

Richard Woodcock's current intellectual scale, The Woodcock-Johnson III, Tests of Cognitive Abilities (WJ III COG), published in 2001, is based on the Cattell-Horn-Carroll (CHC) theory of cognitive abilities (Schrank, et al., 2002; Woodcock & Mather, 2001). The WJ III COG assesses seven broad abilities which align with the CHC theory abilities as defined by Flanagan and Ortiz (2001). Given this, CHC theory provides support for interpretation of the WJ III COG and aids practitioners in identifying students' strengths and weaknesses within the classroom (Schrank, et al.).

While Luria's assessment measures were more subjective in nature, Kaufman and Kaufman were the first to present a practical assessment measure that operationalized Luria's theoretical framework (Reynolds & French, 2005). The original Kaufman

Assessment Battery for Children (K-ABC) published in 1983, applied advances in psychology and neurology theories and research to intellectual assessment and was based on a combination of Luria's neuropsychological theory and the psychobiological cerebral specialization theory (Kamphaus & Reynolds, 1984). This intellectual scale looks at the information processing components of sequential and simultaneous processing; two main components identified in Luria's theory (Kaufman & Kaufman, 2004; Naglieri, 1997; Das, 1984).

The Kaufman Assessment Battery for Children, Second Edition (KABC-II), is a revision of the K-ABC with specific attention to an expanded theoretical foundation (Kaufman & Kaufman, 2004). This revised assessment is grounded in two modern theories; the CHC theory and Luria's neuropsychological theory of processing (Kaufman & Kaufman). Kaufman & Kaufman claim to use a specific set of subtests to produce assessment results that correspond to both theories.

The WJ III COG and KABC –II each provide overall representations of one's cognitive abilities or global scores (Kaufman & Kaufman, 2004; Woodcock & Mather, 2001). These scores are used as overall predictors of one's academic success based on the CHC or Luria factors assessed (Kaufman & Kaufman; Woodcock & Mather). In addition, these scores are utilized by practitioners as IQ scores that determine if a student is identified as having a specific learning disability.

Purpose and Significance of the Study

The purpose of this study will focus on how the CHC components and the global score (General Intellectual Ability- GIA) of the WJ III COG and how the Luria components and global scores (Mental Processing Index - MPI and Fluid Crystallized

Index - FCI) on the KABC –II relate to one another. In addition, this study will also focus on how the MPI and FCI on the KABC-II differ for students classified with a specific learning disability.

These findings are significant as intelligence measures, such as the WJ III GOG and KABC –II, are used in identifying the specific cognitive deficits that are present in children with specific learning disabilities, as well as in developing remedial instructional strategies (Flanagan & Ortiz, 2001; Mather & Roberts, 1994). How the CHC factors on the KABC-II empirically relate with the CHC factors on the WJ III COG for students whom have been identified as meeting the state definition of a specific learning disability requires exploration. In addition, the MPI may offer significantly different information than the FCI, particularly for students with a specific learning disability, given possible difficulties in acquiring new information. These findings could provide practitioners additional information to consider in the course of assessment selection and interpretation.

Research Questions

Given the purpose of this study, the following research questions were developed:

R1: For students classified with a specific learning disability, are the global intellectual scores on the KABC-II (FCI and MPI) significantly different than the global intellectual score on the WJ III COG (GIA)?

R2: For students classified with a specific learning disability, is the MPI significantly different than the FCI on the KABC-II?

R3: For students classified with a specific learning disability, what is the relationship between the CHC factors on the WJ III COG and the CHC factors on the KABC-II?

CHAPTER II

LITERATURE REVIEW

The following discussion focuses on the current use of theoretical positions salient to the development of intellectual scales and the use of intellectual scales to guide school psychologists in developing appropriate intervention plans. This review of literature begins with an introduction which discusses the use of standardized tests and the historical overview of intelligence measures and theory. Following this introduction, several intelligence theories are discussed in detail, including the Cattell-Horn-Carroll Theory and Luria's Neuropsychological Theory. Following each theory discussion, a standardized intellectual scale derived from the previously reviewed theory of intelligence is discussed. Finally, issues related to intelligence testing and the practice of school psychology conclude the literature review.

Introduction

Sattler (2001) indicated that there are four pillars of assessment. These areas include norm-referenced tests, interviews, observations and informal assessment procedures (Sattler). For students classified with specific learning disabilities, standardized assessments, such as intellectual scales, can be useful in identifying specific cognitive deficits (Mather & Roberts, 1994).

One prominent characteristic of individuals with specific learning disabilities is that they do not achieve at a level of expected performance based on their abilities

(Mather & Roberts, 1994). Thus, an assessment tool must be based on an empirically supported theory in order for practitioners to link assessment results to an appropriate intervention plan (Andrews et al., 2001). In order to achieve this, there has been a dramatic shift in test construction and interpretation over the past 20 years (Kaufman, 2000). Many theories defining intelligence have been developed and many researchers have created appropriate intellectual measures that will guide intervention and instruction, particularly in educational settings. Two prominent theories currently used for test interpretation include the Cattell-Horn-Carroll Theory of Cognitive Abilities and Luria's Neuropyshological Theory of Processing.

Cattell-Horn-Carroll Theory of Cognitive Abilities

The Cattell-Horn-Carroll (CHC) Theory of Cognitive Abilities, proposed by McGrew, is an expansion and extension of previously proposed theories of cognitive abilities, including Horn-Cattell's Gf-Gc Model of Intelligence and Carroll's Three-Stratum Theory of Intelligence (McGrew, 1997). The Horn-Cattell Gf-Gc Model of Intelligence, developed in the early 1960s, was initially a theory of two intelligences, Fluid Intelligence and Crystallized Intelligence (Horn & Noll, 1997; Stankov, 2000). Over time, this theory has expanded to a theory of nine intelligences or broad abilities, based on the changes in supporting empirical evidence (Horn & Noll). These intelligences consist of nine broad abilities, including Fluid Intelligence, Crystallized Intelligence, Short-Term Acquisition and Retrieval, Visual Intelligence, Auditory Intelligence, Long-Term Storage and Retrieval, Cognitive Processing Speed, Correct Decision Speed and Quantitative Knowledge (Horn & Noll; McGrew). Reading and writing is a tenth broad ability which could also be included in the Horn-Cattell Gf-Gc Model (McGrew).

John B. Carroll (1996) developed a three-tier model of intelligence through the use of factor analysis of more than 460 sets of data derived from literature. As a result Carroll generated a three stratum theory. Stratum level III consists of a general intelligence factor or "*g*" which represents an overall, general, summative intellectual ability (Carroll, 1996; McGrew, 1997). Stratum level II consists of eight broad factors used to measure the general intelligence factor (Carroll, 1996). These eight factors include Fluid Intelligence, Crystallized Intelligence, General Memory and Learning, Broad Visual Perception, Broad Auditory Perception, Broad Retrieval Ability, Broad Cognitive Speediness and Processing Speed/Decision Speed (Carroll, 1996; Carroll, 1997; McGrew). Finally, Stratum level I consists of 69 narrow abilities used to measure the eight broad abilities (Carroll, 1996; Carroll, 1997). See Figure 1 for an illustration of the three stratum in Carroll's Three Stratum Theory.

The Horn-Cattell Gf-Gc Model of Intelligence contains some similarities and some differences to Carroll's Three-Stratum Theory of Intelligence (McArdle & Woodcock, 1998; McGrew, 1997; McGrew & Flanagan, 1997). One difference is that the Gf-Gc theory proposes that there is no overarching general intelligence factor and instead there are several intelligences or primary mental abilities (Horn & Noll, 1997). Horn and Noll argue that there is more than one kind of ability that can be called intelligence and there is no unifying principle found that unites different forms of intelligence. One similarity in both theories is that they each include broad and narrow abilities (McGrew).

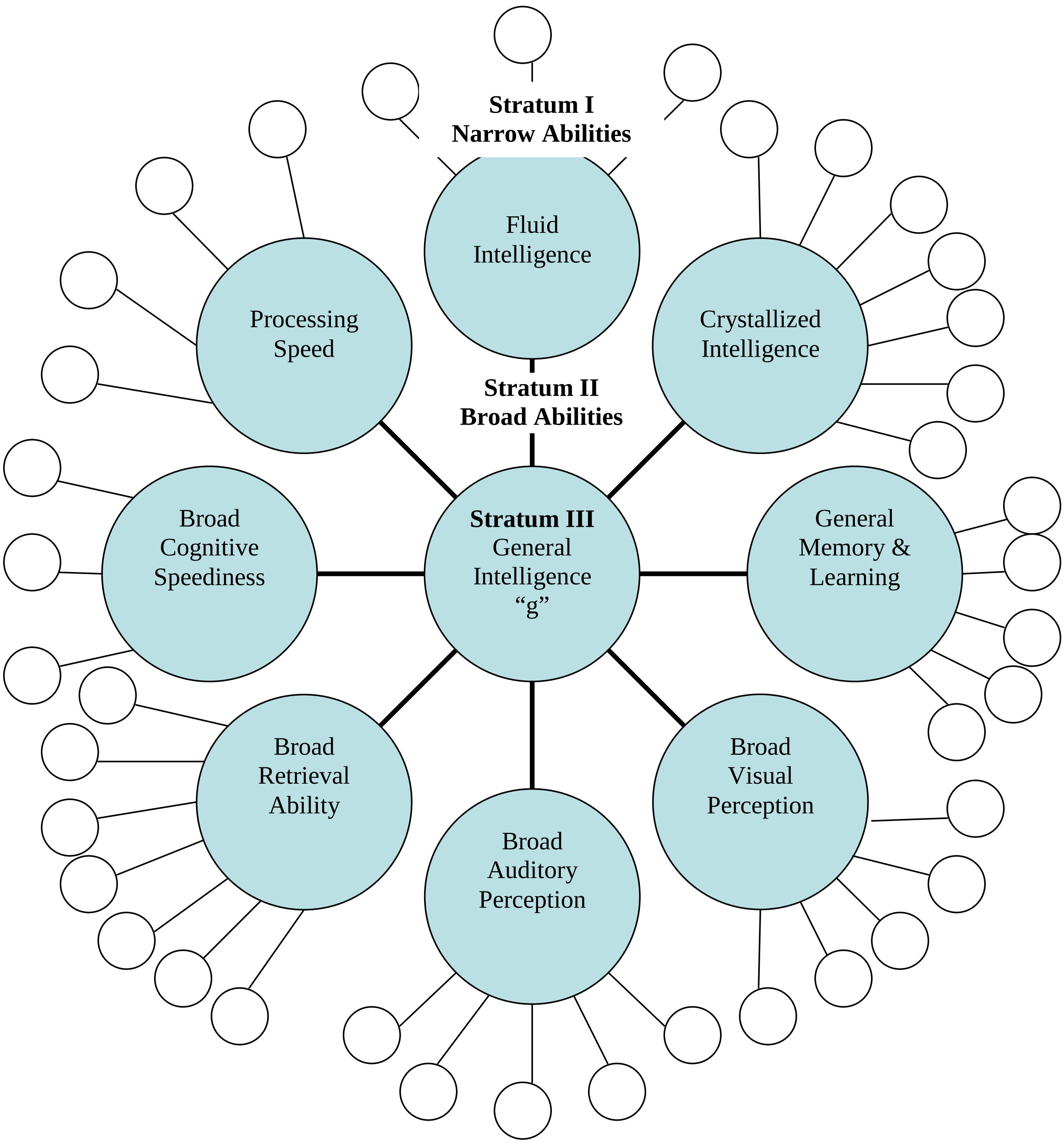

Figure 1. An illustration of the Carroll’s Three Stratum Theory (based on Schrank, et al., 2002).

Given the similarities and overlap between the Three Stratum Theory and the Horn-Cattell Gf-Gc Model of Intelligence, McGrew (1997) proposed a comprehensive model which included ten broad abilities and 70 narrow abilities. This theory was created through the use of confirmatory factor analysis to confirm the broad and narrow factors associated with intelligence; however the existence of an overarching general intelligence factor was not analyzed at that time (McGrew). Given the statistical support for these factors, Flanagan and McGrew (1997) have concluded that "an integration of the three-stratum level theory of cognitive abilities and the Horn-Cattell Gf-Gc theory provides the most comprehensive and empirically supported model of the structure of intelligence currently available."(p. 315). This theory has come to be known as the Cattell-Horn-Carroll or CHC theory (Schrank et al., 2002). The focus of this review will be primarily on the ten broad abilities in the CHC theory. These factors include Fluid Intelligence/Knowledge, Crystallized Intelligence, Quantitative Knowledge, Short-term Memory, Visual Processing, Auditory Processing, Long-term Storage and Retrieval, Processing Speed, Decision/Reaction Time or Speed/ Reading/Writing. See Appendix A for the definitions of these factors.

Woodcock-Johnson III, Tests of Cognitive Abilities

The Woodcock-Johnson III, Tests of Cognitive Abilities (WJ III COG), published in 2001, is based on the Cattell-Horn-Carroll (CHC) theory of cognitive abilities (Schrank et al., 2002; Woodcock & Mather, 2001). Woodcock and Mather report that test items were developed with the objective of adequately measuring the abilities and constructs identified in the specifications derived from CHC theory. Additionally, all three strata of the CHC theory are represented with a primary focus for interpretation on the broad CHC factors or stratum II (Schrank et al.). The WJ III COG assesses broad abilities in the areas of Fluid Reasoning, Comprehension-Knowledge, Short-term Memory, Visual-Spatial Thinking, Auditory Processing, Long-term Retrieval and Processing Speed (Woodcock & Mather). The WJ-III COG factors align with seven of the CHC factors, see Table 1.

Table 1. The alignment of the CHC factors with the WJ-III COG Factors

CHC Factors	**WJ-III COG Factors**
Fluid Intelligence	Fluid Reasoning
Crystallized Intelligence	Comprehension-Knowledge
Short-term Memory	Short-term Memory
Visual Processing	Visual-Spatial Thinking
Auditory Processing	Auditory Processing
Long-term Storage and Retrieval	Long-term Retrieval
Processing Speed	Processing Speed
Decision/Reaction Time or Speed	
Reading/Writing	
Quantitative Knowledge	

Similar to the CHC factor structure, the WJ III COG is comprised of single tests of stratum I narrow abilities, two-test clusters of stratum II broad abilities and a stratum III differentially weighted g-factor composite score (Taub & McGrew, 2004). For descriptions of the WJ-III COG broad ability scales and the subtests used to measure them see Appendix B.

The WJ III COG provides a General Intellectual Ability (GIA) score as an overall representation of one's cognitive abilities or "*g*" and is used as an overall predictor of one's academic success. Factor analysis conducted by Taub and McGrew (2004) revealed that the broad CHC factors most associated with g were Long Term Retrieval (1.0), Fluid Reasoning, (.92), and Visual Spatial Thinking (.91), followed by Short-term Memory (.85), Comprehension-Knowledge (.84), Auditory Processing (.82) and Processing Speed (.64) with a noticeably lower g-loading than the other six CHC factors (Taub & McGrew).

The norming sample of 8,818 subjects for the WJ III COG provides empirical evidence supporting the CHC-derived interpretation of the general intellectual ability and the cognitive abilities assessed on the WJ III COG (Woodcock & Mather, 2001). Two major types of confirmatory factor analyses (CFA) were completed. The first CFA focused on models that included *g* and nine broad CHC factors. The significant loadings supported the interpretation of these tests as indicators of the broad abilities to which they were assigned. Additionally, almost all tests from the WJ III COG only load on a single factor, increasing the confidence in the interpretation of the WJ III COG cluster scores as representing valid indicators of their respective abilities (Woodcock & Mather). The second type of analysis included three levels of factors: *g*, broad CHC factors and narrow CHC factors. The review of fit statistics revealed that on all fit indices for the WJ III COG, the CHC model was the most plausible explanation for the standardization data (Woodcock & Mather). While the CHC model has seen prominence in the literature and operationalized with the WJ-III COG, there is another model of intelligence that has also been advanced as important in the description and measurement of intelligence in the schools.

Luria's Neuropsychological Theory

Luria's neuropsychological theory of processing was derived from Luria's clinical research and observation conducted in Russia (Languis & Miller, 1992; Reynolds & French, 2005). This theory suggests that the brain is composed of three interacting units of processing. These consist of one unit that works to maintain one's arousal and attention, a second unit that receives and integrates information from the environment, and a third unit that involves planning and problem-solving processes (Das, 1984; Kaufman & Kaufman, 2003; Languis & Miller; Luria, 1973; Reynolds & French).

Block one is the arousal and attention unit which is believed to be the basis of all human mental processes because it allows an individual to initiate and regulate his attention (Languis & Miller, 1992; Luria, 1973). Brain activity associated with this unit has been measured during performance on tasks that require selective, focused and sustained attention (Languis & Miller). Topographic brain mapping researchers have suggested that the functions for block one are located in the subcortical areas of the brain stem, including the reticular formation, midbrain, pons and medulla oblongata (Das, 1984; Languis & Miller; Reynolds & French, 2005).

Block two functions are located in the occipital, parietal and frontal temporal lobes and are associated with sensory input and integration processes (Das, 1984; Languis & Miller, 1992; Reynolds & French, 2005). This unit is responsible for receiving, analyzing, encoding and storing incoming information from the external world (Kaufman & Kaufman, 2004; Languis & Miller; Luria, 1973; Reynolds & French).

Successive and simultaneous processing are considered two primary ways in which outside information can be encoded and understood (Kaufman & Kaufman; Languis & Miller). Simultaneous processing is an integration of separate elements of experience into groups (Languis & Miller; Reynolds & French). An example of simultaneous processing includes the KABC subtest Gestalt Closure which required students to fill in and name an incomplete picture (Das). Successive processing is the sequential or linear integration of information (Languis & Miller; Reynolds & French). Examples of successive processing include the subtests Word Order and Digit Span in which students are required to recall information provided to them by the examiner in the same order (Das). Although there are differences between successive and simultaneous processing, there are no specific tasks that exclusively require one or the other, rather they work together to complete tasks (Das; Languis & Miller; Reynolds & French).

Evidence provided through brain mapping suggests that block three functions are located in the frontal region of the brain and are responsible for executive planning and organizing (Languis & Miller, 1992). Such activities include impulse control, regulation of voluntary actions and spontaneous speech as well as planning and problem-solving abilities (Languis & Miller; Luria, 1973; Reynolds & French, 2005).

Although the three units have distinct functions, the three units are constantly interacting in order to perform mental operations and complex behaviors (Das, 1984; Kaufman & Kaufman, 2004; Languis & Miller, 1992). Luria (1973) states that all three units are always involved in all forms of mental processing and that these units cannot carry out specific activities completely independently. “Intelligent behavior, in the Luria model, is the product of the dynamic interplay of the three blocks of the brain” (Reynolds

& French, 2005, p. 102). See Figure 2 for an illustration of the three units in the Luria theory of intelligence.

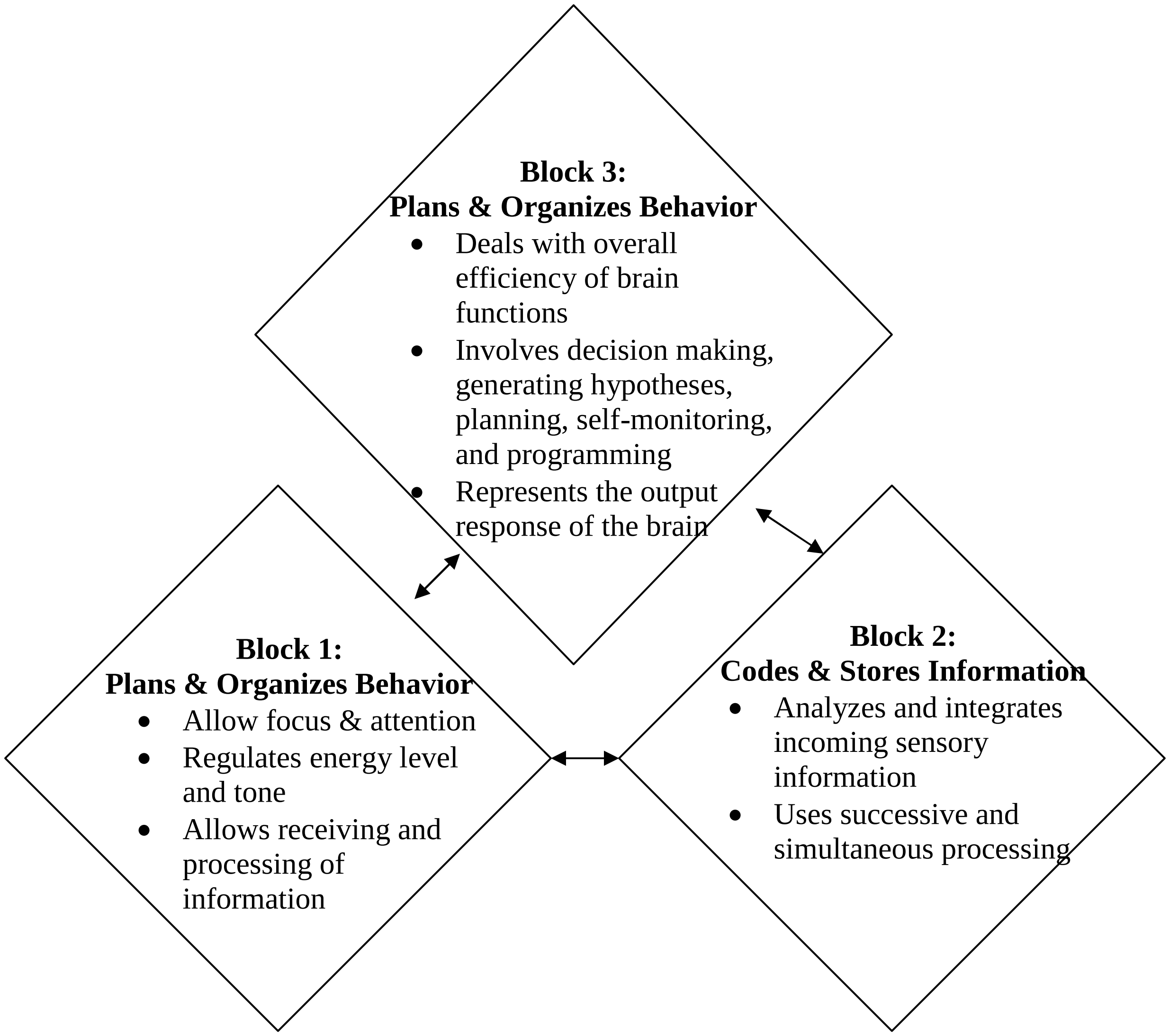

Figure 2. The three units of Luria's theory of intelligence. (based on Kaufman & Kaufman, 2004)

Kaufman Assessment Battery for Children

Alan and Nadeen Kaufman developed the original K-ABC with the goals of assessing intelligence from a strong theoretical base and providing guidance to practitioners with intervention development (Kamphaus & Reynolds, 1984). The

Kaufmans chose to base the Kaufman-Assessment Battery for Children (K-ABC) on the several differing theories based on research in the areas of neuropsychology and cognitive psychology (Kaufman, 1984). The K-ABC is comprised of 16 subtests divided into mental processing and achievement scales, which are administered to children based on their age (Goetz & Hall, 1984; Kamphaus & Reynolds). The subtest scores are combined to determine one's Sequential Processing and Simultaneous Processing, which are combined to determine one's Mental Processing Composite, a measure of one's general intelligence (Sattler, 2001). The K-ABC also includes a separate Achievement Scale and a Nonverbal Scale (Kamphaus & Reynolds). The Achievement Scale is kept separate from the Mental Processing Composite in order to distinguish knowledge one acquired from his/her environment from knowledge gained as a result of educational opportunities (Sattler, 2001). The Nonverbal Scale is used to assess children with speech or language difference (Kamphaus & Reynolds).

The K-ABC generated much discussion, including criticism and controversy in relation to its theoretical perspective, the tasks utilized on the test, the sequential and simultaneous dichotomy, and the achievement versus mental processing dichotomy (Anastasi, 1984; Das, 1984; Goetz & Hall, 1984; Keith & Dunbar, 1984; Sternberg, 1984). First, Das suggests that because all three units of Luria's theory are not assessed, the K-ABC is not fully addressing Luria's theory and therefore does not have a strong theoretical base. The K-ABC looked primarily at the information processing components of sequential and simultaneous processing (Kaufman & Kaufman, 2004, Naglieri, 1997). However, the tasks used to measure these components have been scrutinized and others have concluded that the simultaneous processing subtests are primarily visual tasks, while the sequential subtests are primarily memory tasks (Das; Goetz & Hall; Keith & Bunbar; Sternberg). Furthermore, researchers have noted that several of the subtests have loadings on both successive and simultaneous processing and are not pure measures of the processes they claim to be measuring (Das; Goetz & Hall; Sternberg). Finally, it is argued that distinguishing between achievement and mental processing is questionable as declarative knowledge and procedural knowledge are both required in the problem solving process (Anastasi; Goetz & Hall; Sternberg). In response to these critiques, Kaufman (1984) concludes that such assessments can lead to the development of new instruments from additional theoretical perspectives.

Kaufman Assessment Battery for Children, Second Edition

In order to update the original K-ABC, The Kaufman Assessment Battery for Children, Second Edition (KABC-II) was published in 2004. The K-ABC is a theory based intellectual assessment with an enhanced theoretical foundation (Kaufman & Kaufman, 2004). First, this new intellectual assessment is grounded in two modern theories: the CHC theory and the Luria theory (Kaufman & Kaufman). Kaufman & Kaufman claim to use a specific set of subtests to produce assessment results which correspond to both theories. Eight of the sixteen subtests remain from the original K-ABC and ten new subtests have been added (Kaufman & Kaufman). Furthermore, in addition to sequential and simultaneous processes, planning and learning abilities are also assessed (Kaufman & Kaufman). The KABC-II abilities align with five of the CHC factors, as well as Luria's functions of intelligence, see Table 3.

The KABC-II Scales are used to produce two global scores. The Fluid Crystallized Index (FCI) is an overall representation of one's abilities based on the CHC factors assessed. The other global score, the Mental Processing Index (MPI) provides an overall representation of one's abilities based on the Luria theory factors assessed. The primary differences between the FCI and the MPI are the score interpretation, which is based on the differing theoretical perspectives. The FCI was derived from the CHC perspective and measures five broad abilities and the general cognitive abilities as defined in Stratum III. The MPI is derived from the Luria model and excludes the Knowledge/Crystallized Ability Scale because content is not emphasized in Luria's theory (Kaufman & Kaufman, 2004). See Table 2 for the alignment of the KABC-II scales with the CHC factors and the Luria factors. For descriptions of the KABC-II Scales and the subtests used to measure them see Appendix C.

Table 2. The alignment of the KABC-II Scales with CHC and Luria factors

KABC-II Scale	**CHC Factors**	**Luria Factors**
Sequential/Gsm	Short-term Memory	Sequential Processing
Simultaneous/Gv	Visual Processing	Simultaneous Processing
Learning/Glr	Long-term Storage and Retrieval	Learning Ability
Planning/Gf	Fluid Intelligence	Planning Ability
Knowledge/Gc	Crystallized Intelligence	
	Auditory Processing	
	Processing Speed	
	Decision/Reaction Time or Speed	
	Reading/Writing	
	Quantitative Knowledge	

Confirmatory factor analysis studies conducted with the norming sample indicate that the core subtests have high loadings and are strong measures of their respective factors. Additionally, the loadings for the abilities factors with the general factor are also high suggesting that each of the abilities assessed are influenced by the general ability factor. Confirmatory factor analytical data also indicate that the core subtests at each age have good fit to the data (Kaufman & Kaufman, 2004).

Correlation studies comparing the original K-ABC with the current KABC-II show that the Sequential Processing Factor on the K-ABC correlates highly with the Sequential/Short term Memory scale on the KABC-II (.76 for ages 3 to 5 and .78 for ages 8 to 12). The Simultaneous Processing scale on the original K-ABC has lower correlations with the current KABC-II Simultaneous/Visual Processing Scale (.62 for ages 3 to 5 and .69 for ages 8 to 12). Mean scores on the MPI of the KABC-II are lower than those on the Mental Processing Composite (MPC) on the original K-ABC by about 7 points for ages 3 to 5 (correlation of .65) and 6 points for ages 8 to 12 (correlation of .85), differences that can be accounted for by the Flynn Effect. The MPC correlates higher with the KABC-II FCI (.72) then with the MCI for ages 3 to 5, however, in age 8 to 12 the correlations are about the same (Kaufman & Kaufman, 2004).

Correlation studies comparing the KABC-II with the WJ III COG indicated that the mean KABC-II FCI is slightly higher (0.4 points) than the mean WJ III COG GIA. The correlations of the WJ III COG GIA with the KABC-II FCI are .77, and .78 with the MPI. The highest correlation between the two tests is between the KABC-II Knowledge/Crystallized Knowledge and the WJ III COG Comprehension Knowledge Composite (.84). The measure of Fluid Reasoning correlates with Planning/Fluid

Reasoning at .64, the Visual Spatial Processing with Simultaneous/Visual Processing correlate at .51 and Working Memory with Sequential/Short-term Memory at .55. Correlations of the WJ III COG measure of Long Term Retrieval with the KABC-II measure of Learning/Long-term Storage and Retrieval were not reported. There were no children with a special-education classification included in this sample (Kaufman & Kaufman, 2004). Therefore, it is important to examine how the CHC factors on the KABC-II empirically relate with the CHC factors on the WJ III COG for students whom have been identified as meeting the state definition of a specific learning disability in order to assist practitioners in determining appropriate remediation.

Studies of Students with Learning Disabilities with the WJ III COG and KABC-II

Validity studies conducted during the standardization of the WJ III COG explored the differences of scores between students with learning disabilities and those without disabilities (Woodcock & Mather, 2001). One study was conducted at the Gregg and Hoy University. Comparisons of the mean scores between the two groups revealed significant differences at the .05 level in all areas except Visual-Spatial Thinking. Students classified as having a learning disability showed the greatest significant difference in scores in the areas of Auditory Processing (-11.7), Working Memory (-11.1) and their overall General Intellectual Ability Score (-11.8).

Validity studies conducted during the standardization of the KABC-II compared scores of students who met the criteria for the classification of a learning disability in the areas of reading, math and written expression with students who did not meet criteria for a disability (Kaufman & Kaufman, 2004). When comparing their overall mean of scores in each area, statistically significant differences in all factors were noted, with the largest difference occurring with the global index scores (FCI and MPI), ranging from -16.0 to -18.4. The amount of significant differences for the FCI and MPI in each area were nearly identical to one another, indicating little or no effect on the global score of student's with learning disabilities with the inclusion of the measure of Knowledge/Crystallized Intelligence (CHC factor). Students classified as meeting the criteria for disability in reading and students classified as meeting the criteria for a disability in written expression demonstrated the largest differences on the Learning/Long Term Storage and Retrieval factor (-14.6 and -14.8 respectively) in comparison with their non-disabled peers. In Mathematics, students with a learning disability demonstrated the largest difference in the area of Planning/Fluid Reasoning (-15.9) in comparison with students without a learning disability.

Applications of Theoretical Intellectual Assessment in Intervention Planning

One of the most frequently mentioned needs of students with specific learning disabilities is individualized instruction utilizing carefully selected instructional strategies (Mather & Roberts, 1994). Research summarized by McGrew and Flanagan (1997) indicated that assessments that do not assess abilities that are not important for school achievement do not offer any additional intervention information to educators. In fact, practitioners with knowledge regarding which cognitive processes are strongly related to particular achievement areas, can tailor assessments to referral concerns (Schrank et al., 2002).

The use of intellectual assessment results for the development of classroom intervention has been controversial among researchers (Fiorello et al., 2007; Keith, 2000). Sattler and Saklofske (2001) suggest that when interpreting intellectual assessment results, the use of profile analysis can be beneficial in formatting interventions. However, much of the research does not support such analysis (Gresham & Witt, 1997; McDermott & Gutting, 1997; McDermott, Fantuzzo, Glutting, Watkins & Baggaley, 1992). Conversely, Naglieri (2000) argues that a strong theoretical basis is needed in order to adequately analyze student profiles and determine appropriate intervention.

The WJ III COG provides scores for interpretation at all three levels of the CHC theory, including nine broad cognitive abilities defined by the CHC theory (Schrank et al., 2002). More specifically, the CHC theory provides support for interpretation and aids practitioners in identification of specific skills and abilities which require remediation (Schrank et al., 2002). For example, a study completed by Evens, Floyd, McGrew and Leforgee (2003) looked at the relationship of CHC abilities and mathematical achievement in students aged 6-19 and found that the WJ III COG Comprehension Knowledge and Fluid Reasoning abilities are strongly related to Mathematical Reasoning abilities and Processing Speed abilities are strongly related to Math Calculation abilities. Mather and Jaffe (2002) recommend relating new information to acquired information and incorporating an individual's interests into teaching new material in order to help increase a student's performance in relation to Comprehension Knowledge. Furthermore, Mather and Jaffe (2002) suggest teaching a student specific problem solving skills, having the student overlearn information through the use of repetition and review as well as using real objects and manipulatives to aid the student in learning a new concept are possible ways to increase performance in Fluid Reasoning. Combining these techniques during math instruction could be beneficial to a student demonstrating these weaknesses.

Similarly, a study looking at the relationship of the CHC abilities as measured on the WJ III COG with reading achievement indicated that Short-Term Memory, Processing Speed and Long-Term Retrieval are strongly correlated with reading abilities (Evens, Floyd & McGrew, 2002). Again, Mather and Jaffe (2002) have recommendations related to each area of weakness identified. To increase one's performance in the area of Short-term Memory it may be beneficial to have a student paraphrase instructions or provide the student with a study guide or teach the student memory strategies, such as chunking or verbal rehearsal. Processing Speed can be addressed by providing a student more time to complete assignments or reducing the quantity of work to increase the quality of the work or providing activities such as flash cards to increase one's rate and fluency. Finally, Long -Term Retrieval concerns can be addressed by providing overlearning and repetition, teaching memory aids such as rehearsal and mnemonic strategies and limiting the amount of new information presented in one learning session (Mather & Jaffe). Applying these strategies during reading instruction is likely to be beneficial for a student struggling in these areas with reading concerns.

Overall, a review of research by McGrew and Flanagan (1998) investigating comparisons of CHC abilities with reading and math achievement indicated that although there are some abilities more commonly associated with particular academic skills, these abilities may differ by individual. Therefore, with proper analysis of a student's performance on the WJ III COG in combination with the CHC theoretical interpretation can lead to appropriate and effective remediation for students classified with Learning Disabilities.

Languis and Miller (1992) reported that using Luria theory educational interventions can be designed and implemented from a cognitive-science basis through brain mapping to make connections between brain processing and task performance. Suggestions for interventions include the teacher making appropriate accommodations based on the student's cognitive processing patterns and teaching the student self-management skills. Furthermore, progress could be monitored through the use of pre-and post-testing with brain mapping to evaluate changes associated with cognitive interventions (Languis & Miller, 1992). Shaywitz (2003) looked specifically at brain mapping and intervention for students with reading disabilities or dyslexia. Brain imaging studies found that students with dyslexia show different brain activation patterns than good readers. More specifically, dyslexic readers show an underactivation of neural pathways in the back of the brain and an overactivation in frontal regions of the brain in comparison with good readers (Shaywitz, 2003). Brain images after a year long reading intervention showed brain activation comparable to good readers (Shaywitz). This type of intervention monitoring and evaluation supports the suggestions made by Languis and Miller in applying Luria's brain mapping research of cognitive processing.

Summary

In order to comply with classification definitions of a learning disability in most states, School Psychologists frequently use standardized intellectual scales to identify specific cognitive deficits (Flanagan & Ortiz, 2001; Mather & Roberts, 1994). In order to link assessment results to an appropriate intervention plan, these intellectual scales must be based on an empirically supported theory (Andrews et al., 2001). The Woodcock-Johnson III, Tests of Cognitive Abilities (WJ III, COG), published in 2001, is based on the Cattell-Horn-Carroll (CHC) theory of cognitive abilities (Schrank et al., 2002; Woodcock & Mather, 2001). The Kaufman Assessment Battery for Children, Second Edition (KABC-II) is based on two modern theories: the CHC theory and the Luria theory (Kaufman & Kaufman, 2004). Research has indicated that both the CHC and Luria theories can provide practitioners with practical information which can be used to plan assessments and interventions for students with learning disabilities (Evens et al, 2002; Evens et al., 2003; Languis & Miller, 1992; Mather & Jaffe, 2002; McGrew & Flanagan, 1998; Shaywitz, 2003).

CHAPTER III

METHODOLOGY

This study had multiple purposes. The first purpose of this study was to determine how the two global scales on the KABC-II, the Fluid Crystallized Index (FCI) and the Mental Processing Index (MPI) compare with the Global Intellectual Ability (GIA) score on the WJ III COG for students classified with a Specific Learning Disability. A second purpose of this study was to determine if the two global intellectual scales, the FCI and the MPI, provide significantly different scores for students classified with a Specific Learning Disability, due to the exclusion of Crystallized Ability from the MPI scale. Finally, a third purpose was to determine how the Cattell-Horn-Carroll Theory (CHC) factors on the Woodcock Johnson III, Tests of Cognitive Abilities (WJ III COG) and the CHC and Luria factors on the Kaufman Assessment Battery for Children, Second Edition (KABC-II) relate to one another, specifically in children with learning disabilities.

This section will explain the participants and procedures used for data collection in this study. Then, the measures used in the study will be detailed, and both reliability and validity of the instrument will be provided. Finally, the hypotheses and data analysis of the study will be provided.

Participants

A total of thirty participants classified as having a learning disability, ages 7 -18, were gathered for this study. This sample was selected for several reasons. First, school psychologists spend more than fifty percent of their time assessing students for specific learning disabilities (Reschly & Wilson, 1995). Second, school aged students identified as meeting the criteria for a Specific Learning Disability provided scores to accurately explore the purpose of this study. There was no preliminary determination of which students would be involved, rather students were assessed as consent was returned. Fourteen of the participants were female and 16 were male. Furthermore, 13 students were from Marion, WI and 17 from New London, WI.

Marion is a rural community serving a student population of approximately 600 students, grades 4K through 12. There is one Elementary School and one Middle/High School. Ninety-five percent of the student population is white and less than five percent of the students are Hispanic, Native American or Asian ethnicities. Thirty-three percent of the school district's student population receives free or reduced priced lunch. Approximately 14 percent of the student population is identified as students with exceptional education needs requiring special education programming.

The New London School District serves students living in a rural community. There are four elementary schools, one middle school and one high school. There are approximately 2,439 students attending the New London Public Schools, ages 3-21. Ninety-two percent of the student population is white, 6.2 % is Hispanic, 0.7% is Black, 0.6% is Asian and 0.2% is American Indian. Twenty-three percent of the school district's student population receives free or reduced priced lunch. Approximately twelve percent of the student population is identified as students with disabilities requiring special education programming.

Procedures

Prior to data collection beginning within the school settings, permission from the UW-La Crosse IRB committee was obtained to ensure ethical procedures were followed within the context of this study. I contacted schools to solicit interest in this project. Active consent forms were sent to parents of students ages 7 to 18 who had been classified with a learning disability, requesting permission for their child to participate in this study. Once consent was obtained, students were selected and informed that assessments may take two sessions with each session lasting approximately an hour and a half. If the student did not wish to participate in the study, the student was excused. See Appendix D for samples of the consent forms.

Once permission from the student was obtained, students whom had previously been administered the WJ III COG or the KABC-II within the last 3 years were administered the other intellectual scale only. Students who had not been administered the WJ III COG or KABC-II within the last 3 years were administered both tests at different times, alternating the order of administration for each student. Students were not tested for longer than a two hour period and following each testing session, students were compensated with $5.00 for their time. Students' information regarding test results from the WJ III COG and the KABC-II are confidential. Their identification information will not be released.

Instruments

The CHC factors and Luria factors were measured using the Woodcock Johnson III, Tests of Cognitive Abilities (WJ III COG) and the Kaufman Assessment Battery for Children, Second Edition (KABC-II). Both measures have a mean of 100 and a standard deviation of 15 (Kaufman & Kaufman, 2004; Woodcock & Mather, 2001b).

The WJ III COG assesses one's abilities in the areas of Comprehension-Knowledge (Gc), Long-Term Retrieval (Glr), Visual-Spatial Thinking (Gv), Auditory Processing (Ga), Fluid Reasoning (Gf), Processing Speed (Gs) and Short-Term Memory (Gsm) (Woodcock & Mather (2001b). See Table 3 for the reliability statistics for the WJ III COG CHC clusters and the General Intellectual Ability Score for ages 2 -80. The Standard Error of Measurement values are reported by the range of scores obtained across the age levels. This table reveals that most median reliabilities for each cluster are .90 or higher.

Table 3. Cluster Reliability Statistics for the WJ III COG (Woodcock & Mather, 2001b).

Cluster	**Range of Standard Error of Measurement Values**	**Median Cluster Reliability Coefficient**
General Intellectual Ability	1.50-2.60	.98
Comprehension-Knowledge	2.12-4.24	.95
Long –Term Retrieval	3.97-8.22	.88
Visual-Spatial Thinking	5.20-8.22	.81
Auditory Processing	3.00-5.61	.91
Fluid Reasoning	3.00-7.56	.95
Processing Speed	2.60-6.18	.93
Short-term Memory	3.72-6.18	.88

Internal Structure Validity is the measure of the strength of the relationship between the test components and the theoretical basis of the test components. See Table 4 for the range of intercorrelation validity scores for the CHC clusters on the WJ III COG across ages 6-13 as reported by Woodcock and Mather (2001b). This intercorrelational data provides evidence that each test cluster is an independent measure from the other test factors.

Table 4. The Range of Cluster Score Intercorrelations on the WJ III COG

Cluster	**GIA**	**Gc**	**Glr**	**Gv**	**Ga**	**Gf**	**Gs**
Gc	.79-.81						
Glr	.68-.73	.47-.52					
Gv	.44-.48	.25-.32	.37-.38				
Ga	.59	.44	.40-.41	.26-.27			
Gf	.81	.53-.55	.52-.58	.34-.36	.39-.40		
Gs	.62-.68	.34-.38	.39-.46	.29-.30	.31-.33	.37-.45	
Gsm	.72-.74	.43-.47	.44-.48	.25-.27	.37	.47-.49	.34-.41

The KABC-II measured Planning Ability, Learning Ability, Sequential Processing and Simultaneous Processing from the Luria theory along with Short-Term Memory, Long-Term Storage and Retrieval, Fluid Reasoning, Visual Processing and Crystallized Ability from the CHC theory (Kaufman & Kaufman). In addition, the KABC-II offered two global scales. The Fluid Crystallized Index (FCI) is an overall representation of one's abilities based on the CHC factors assessed. The second scale, the Mental Processing Index (MPI) provided an overall representation of one's abilities based on the Luria factors assessed. See Table 5 for the reliability statistics for the KABC-II CHC factors, Luria factors and global index scores for ages 7-12. The Standard Error of Measurement values are reported by the range of scores obtained across age levels as reported by Kaufman & Kaufman (2004). See Table 6 for the intercorrelation validity scores for the CHC/Luria clusters on the KABC-II for ages 7-12.

Table 5. Reliability statistics for the KABC-II

Cluster	**Range of Standard Error of Measurement Values**	**Test-Retest Reliability**
Sequential/Short-term Memory	4.68-5.51	.80
Simultaneous/Visual Processing	4.93-5.63	.76
Learning/Long-term Retrieval	3.90-4.32	.76
Planning/Fluid Reasoning	3.24-5.83	.82
Crystallized Intelligence	3.63-4.58	.88
FCI	2.66-2.91	.91
MPI	2.95-3.36	.89

Table 6. Intercorrelation validity scores for the CHC/Luria Clusters on the KABC-II

Cluster	**Seq/Gsm**	**Sim/Gv**	**Learning/Glr**	**Planning/Gf**	**Gc**	**FCI**
Simultaneous/Gv	.34					
Learning/Glr	.31	.42				
Planning/Gf	.36	.53	.47			
Gc	.39	.49	.51	.61		
FCI	.63	.74	.74	.79	.81	
MPI	.67	.76	.75	.79	.67	.98

Hypotheses

The following null hypotheses will be analyzed:

1. There will be no significant differences between the global intellectual scores on the KABC-II (FCI and MPI) and the global intellectual score on the WJ III COG (GIA)
2. There will be no significant differences between the MPI and FCI scores for students classified with learning disabilities.
3. There will be no correlation between the CHC factors measured with the WJ III COG than the CHC factors measured with the KABC-II for students classified with a learning disability.

Data Analysis

In order to determine if differences exist between the global intellectual scores on the KABC-II and the WJ III COG, data was analyzed using a paired-sample t test. Next, the CHC factors from the WJ III COG were correlated with the CHC/Luria factors on the KABC-II. Each factor was compared to all other factors in order to determine how independently each factor was measured on each intellectual scale.

CHAPTER IV

RESULTS

This study looked at multiple research questions regarding the differences between the global intellectual scores on the KABC-II, the global intellectual score on the WJ III COG (GIA) as well as the differences between the two global scores on the KABC-II. Additionally, it looked at the relationship between the CHC factors on the WJ III COG and the CHC factors on the KABC-II. This chapter begins with the descriptive statistics of students' scores and then follows with the results and discussion of each research question.

The means, standard deviations and minimum and maximum scores earned by students tested with the KABC-II are provided in Table 7. These data show that the students' mean of subtest and global scores fell between 86 and 92, with standard deviations ranging from 7 to 13. This suggests that as a group, these students earned mean scores primarily in the low average range on the KABC-II and lower than the overall performance of students in the standardization sample. The standard deviations are also smaller than those from the standardization sample. This restricted range suggests less variability of scores for students with specific learning disabilities than found in students without specific learning disabilities. This data also shows a large range of scores with a minimum score of 54 and a maximum score of 123. This suggests that students with Specific Learning Disabilities tend to demonstrate significant variations within their cognitive processing.

Table 7. Descriptive Statistics for Students Tested with the KABC-II (n = 30)

	Mean	Standard Deviation	Minimum	Maximum
Sequential/Gsm	87.90	11.68	66	112
Simultaneous/Gv	92.00	13.92	58	118
Learning/Glr	93.47	9.68	81	123
Planning/Gf	89.73	12.05	54	117
Knowledge/Gc	88.33	7.37	72	100
Fluid Crystallized Index (FCI)	86.97	8.52	68	106
Mental Processing Index (MPI)	87.83	10.22	66	111

The means, standard deviations and minimum and maximum scores earned by students tested with the WJ III COG are provided in Table 8. These data show that the students' mean standard scores on the WJ III COG subtests and global scores fell between 85 and 95, with standard deviations ranging from 7 to 18. This suggests that as a group, these students earned mean scores primarily in the low average range on the WJ III COG and lower than the overall performance of students in the standardization sample. The standard deviations are also smaller than those from the standardization sample. This restricted range suggests less variability of scores for students with specific learning disabilities than found in students without specific learning disabilities. This data also show a large range of scores with a minimum score of 26 and a maximum score of 127. This data suggests that students with Specific Learning Disabilities tend to demonstrate significant variations in their cognitive processing.

Table 8. Descriptive Statistics for Students Tested with the WJ III COG (n = 30)

	Mean	Standard Deviation	Minimum	Maximum
Comprehension Knowledge	89.37	7.95	70	105
Long-term Retrieval	85.80	8.57	70	105
Visual-Spatial Thinking	94.47	7.89	76	114
Auditory Processing	95.90	13.44	72	127
Fluid Reasoning	89.67	9.56	69	109
Processing Speed	88.27	18.91	26	119
Short-Term Memory	86.27	9.77	64	107
General Intellectual Ability (GIA)	85.53	9.26	54	101

One of the main questions that this study examined is the difference between the various scores across intelligence tests and within the KABC-II based on the different theoretical models. For the first part of this question, both global IQ scores on the KABC-II were compared to the global IQ score for the WJ-III COG. In a paired t-test neither the FCI, $t(29) = 1.09$, $p > .05$, nor the MPI, $t(29) = 1.46$, $p > .05$, were significantly different from the GIA. In addition, the FCI was not significantly different from the MPI, $t(29) = -1.72$, $p > .05$. The results, as hypothesized, show that there is no significant difference between the mean of students' global scores on the KABC-II and the WJ III COG and there is no significant difference between the two global scores on the KABC-II. In addition, there are significant correlations between the global scores on each test. The GIA is correlated with the FCI at .68, and with the MPI at .61. The MPI and FCI are correlated at .97. A visual description of the different IQ scores can be seen in Fig 3.

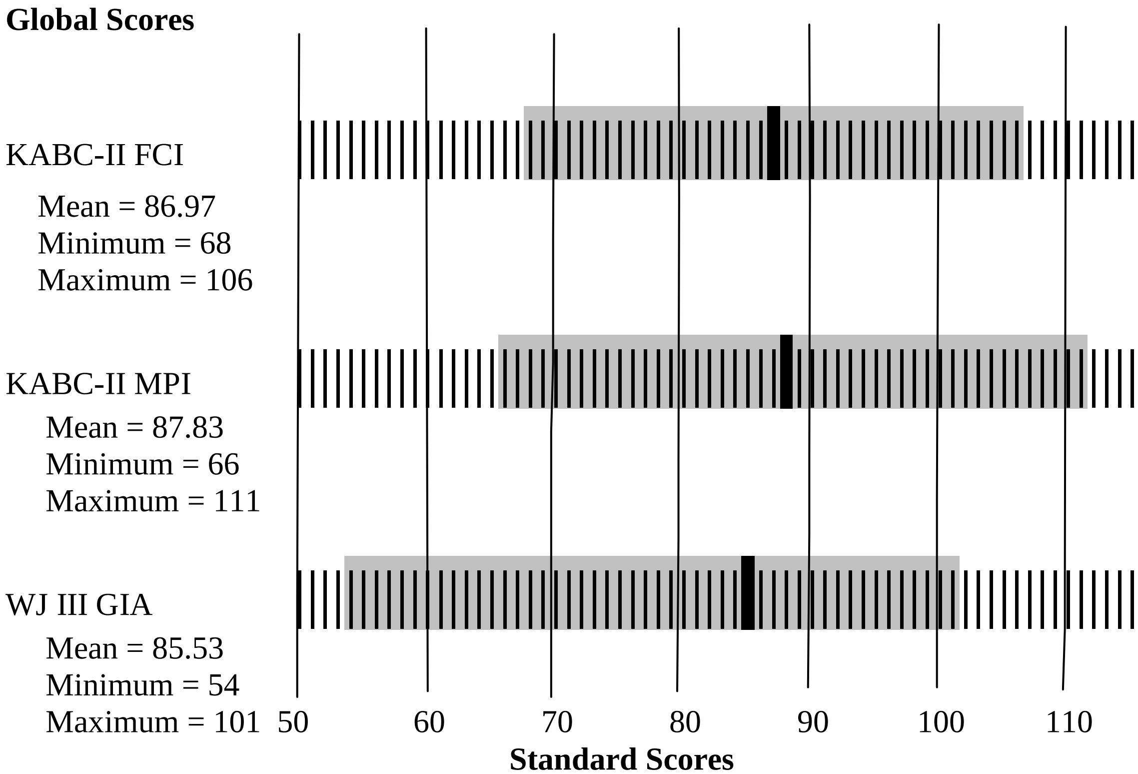

Figure 3. KABC-II and WJ III COG Global Score Comparisons

The second question examined if students with specific learning disabilities had a similar pattern of performance across the different IQ measures. A one-tailed correlation matrix was computed for the factors on the KABC-II and the WJ-III COG (see Table 9).

Table 9 shows 24 significant correlations between the CHC factors on the WJ III COG and the KABC-II for students with specific learning disabilities. When looking specifically at the subtests on the KABC-II and the WJ III COG that measure the same CHC factors, significant correlations exist (see table 10).

Table 9. Intercorrelations Between CHC Factors on the KABC-II and the WJ III COG

	KABC-II				
Scales	Sequential/Gsm	Simultaneous/Gv	Learning/Glr	Planning/Gf	Knowledge/Gc
WJ III COG					
Comprehension Knowledge	.58**	.32*	.45**	.57**	**.70****
Long-term Retrieval	.38*	.03	**.43****	.02	.20
Visual-Spatial Thinking	.34*	.43*	.29	**.64****	.09
Auditory Processing	**.43****	.00	.16	.27	.41*
Fluid Reasoning	-.01	.16	.19	**.48****	.27
Processing Speed	.10	.29	.08	**.50****	.10
Short-term Memory	**.59****	.44**	.39*	.38*	.44**

n=30

**Correlation is significant at the .01 level (1-tailed)

*Correlation is significant at the .05 level (1-tailed)

Table 10. Intercorrelations between the KABC-II and WJ III COG Scales Related to the Same CHC Factor

CHC Factors	KABC-II Scale	WJ-III COG Scale	Correlations
Short-term Memory	Sequential/Gsm	Short-term Memory	.59**
Visual Processing	Simultaneous/Gv	Visual-Spatial Thinking	.43**
Long-term Storage and Retrieval	Learning/Glr	Long-term Retrieval	.43**
Fluid Intelligence	Planning/Gf	Fluid Reasoning	.48**
Crystallized Intelligence	Knowledge/Gc	Comprehension-Knowledge	.70**

**Correlation is significant at the .05 level (1-tailed)

A correlation study between the WJ III COG and the KABC-II with regular education students was conducted during the KABC-II standardization (Kaufman & Kaufman, 2004). Of the scores reported, higher correlations were found in the standardization sample between the composite scores for the corresponding CHC factors than were found in this study. The highest correlation reported was between the KABC-II Knowledge/Gc and the WJ III COG Comprehension Knowledge (.84). The two measures of Fluid Reasoning and the two measures of Visual Processing were also significantly correlated (.64 and .51 respectively)(Kaufman & Kaufman). Similar to findings in this study, the KABC-II Simultaneous/Gv composite had a higher correlation with the WJ III COG Fluid Reasoning composite than with the Visual Processing composite. Correlations for the other CHC factors were not reported.

CHAPTER V

DISCUSSION

The purpose of this study was to examine the theoretical basis for two different cognitive measures. This was done in order to provide practitioners with additional information to consider in the course of assessment selection and interpretation for students identified with specific learning disabilities. This chapter begins with a discussion of these findings, followed by implications this research has on the field of school psychology, and concludes with limitations of this study and direction for future studies.

First, as hypothesized, it was found that there is no significant difference between the mean of students' global scores on the KABC-II and the WJ III COG and no significant difference between the two global scores on the KABC-II. It is likely that this lack of difference is related to the similarities between the tests. Each intellectual measure is grounded in the Cattell-Horn-Carroll theory of cognitive abilities, suggesting similarities between the tasks on the tests (Kaufman & Kaufman, 2004; Woodcock & Mather, 2001). In addition, the KABC-II utilizes an overlapping set of subtests to produce assessment results that correspond to the CHC theory as well as Luria's neuropsychological theory of processing, thus suggesting similar global scores.

Second, for students with specific learning disabilities, it was found that there were 24 significant correlations between their scores assessing CHC factors on the WJ III

COG and the KABC-II. More specifically, when looking at the composite scores on the KABC-II and the WJ III COG that measure the same CHC factors, significant correlations exist. This would be expected given the correlations found in the initial studies reported by Kaufman during the standardization process of the KABC-II (2004). However, significant correlations also exist between composite scores not measuring the same CHC factor, and in some instances composite scores representing different CHC factors have higher correlations. For example, the KABC-II Simultaneous/Gv composite score has a higher correlation with the WJ III COG Short-term Memory composite score than with the corresponding CHC factor of Visual-Spatial Thinking. The Learning/Glr composite has a higher correlation with Comprehension Knowledge, rather than Long-Term Retrieval. Planning/Gf has a higher correlation with Visual-Spatial Thinking and Comprehension Knowledge than with Fluid Reasoning. These unexpected correlations suggest that the composite scores representing each CHC factor may not be interpreted as a measure of the factor to which it was assigned, but rather as mixture of factors for students with specific learning disabilities. It also suggests that multiple cognitive abilities are used when completing tasks and that it is difficult to perform a task that isolates one factor.

In addition, when looking at the correlations between the CHC factors measured on the KABC-II and the WJ III COG, Simultaneous/Gv does not have the highest correlation with any of the WJ III COG factors. Futhermore, Sequential/Gsm has the highest correlations with Auditory Processing and Short-term Memory. Planning/Gf has the highest correlations with Visual-Spatial Thinking, Fluid Reasoning and Processing Speed. These findings suggest that the scores representing each CHC factor may not be interpreted in isolation for students with learning disabilities. It could also suggest that cognitive processing deficits displayed by students with Specific Learning Disabilities could have impacted the relationship between the corresponding factors.

The WJ III COG Short-term Memory Composite score significantly correlates with all of the KABC-II composite scores. This suggests that memory may be an indicator in all of the KABC-II subtests. This may also impact how students with specific learning disabilities perform on this assessment.

There were significant correlations found between the global scores, with the highest correlation between the MPI and FCI. These correlations are higher than all but 2 factor correlations. This suggests that similar cognitive abilities may be compared more effectively at the global level than at factor structure level.

Students with specific learning disabilities were selected to participate in this study. The correlation study with regular education students that was conducted during the KABC-II standardization reported higher correlations were found in the standardization sample between the composite scores for the corresponding CHC factors than were found in this study. These differences could be a result of processing deficits and variance often displayed in students with specific learning disabilities.

Implications to School Psychology

Ninety-eight percent of states include the concept of a severe discrepancy between IQ scores and achievement scores in their classification definitions of a learning disability (Flanagan & Ortiz, 2001; Mather & Roberts, 1994). However, the use of intellectual assessment results for educational programming has been controversial among researchers (Fiorello et al., 2007; Keith, 2000). Sattler and Saklofske (2001) suggest that when interpreting intellectual assessment results, the use of profile analysis can be beneficial in formatting interventions. However, much of the research does not support such analysis (Gresham & Witt, 1997; McDermott & Gutting, 1997; McDermott, Fantuzzo, Glutting, Watkins & Baggaley, 1992).

The findings in this study suggest that school psychologists may want to continue to focus on global scores, rather than focusing on factor analysis. However, the correlations between factors may be stronger when comparing individual student performance across factors.

Naglieri (2000) suggested utilizing a theory-based approach to subtest analysis, rather than looking at relative ipsative strengths and weaknesses. His study focused on applying the Planning, Attention, Simultaneous and Successive (PASS) theory to the Cognitive Assessment System (Naglieri). He found that the presence of cognitive weaknesses was significantly related to academic achievement and the presence of a relative weakness was not. Since the WJ III COG and the KABC-II are both theory-based assessments, this alternative factor analysis may be of greater value when identifying children with learning difficulties and may aid practitioners with intervention planning (Naglieri, 2000).

Limitations and Future Research

This study does have limitations. The students tested for this study were identified with specific learning disabilities. Specific Learning Disabilities encompass a range of different academic skill deficits that may be manifested in different patterns of cognitive processes. Students in this study were not separated based on the specific area of learning disability. Therefore, cognitive profiles that may be associated with any specific academic skills were not examined. Future research focused on the comparison between students with specific learning disabilities in the varying academic areas may provide insight to cognitive differences that would help a School Psychologist draw conclusions based on assessment results.

Furthermore, in this study the composite factor and global scores for each test were compared, however, the subtests that make up the composite scores were not examined. Therefore confirmatory factor analyses looking at how each subtest loads on each of their assigned factors was not conducted for students with specific learning disabilities. It is likely that differences within composite scores and for some students do exist. These differences could potentially impact the interpretation of the composite scores. Further exploration at the subtest level could potentially provide School Psychologists with the ability to analyze student performance on individual tasks and allow further examination of cognitive functioning.

In addition, there were no reliability checks completed in relation to the scoring of these assessments. Results of reliability analyses could reveal potential scoring errors, thus invalidating the scores produced which would ultimately impact the findings of this study. Further examination in this area could potentially validate these findings.

Finally, the sample size for this study did not allow for the examination of diverse populations. Further research with participants from different socioeconomic levels and ethnic groups should be examined. This data may impact the findings in a similar study.

Conclusion

Based on the findings in this study, one can conclude the composite scores representing each CHC factor on the WJ III COG and KABC-II may not be interpreted in isolation of the other factors for students with Specific Learning Disabilities. Cognitive processing deficits displayed by students with Specific Learning Disabilities may impact the measurement of these factors. As a result, school psychologists may want to continue to focus on global scores when looking at cognitive processing, rather than focusing on factor analysis.

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APPENDIX A

CHC BROAD ABILITY DEFINITIONS

CHC Broad Ability Factors	Definitions
Fluid Intelligence/Knowledge	Mental operations that an individual uses when faced with a novel task that cannot be performed automatically.
Crystallized Intelligence	The breadth and depth of a person's accumulated knowledge of a culture and the effective use of that knowledge.
Quantitative Knowledge	An individual's store of accumulated quantitative, declarative and procedural knowledge.
Short-term Memory	The apprehension and holding of information in immediate awareness as well as the ability to use the information within a few seconds.
Visual Processing	The generation, perception, analysis, synthesis, storage, retrieval, manipulation and transformation of visual patterns and stimuli.
Auditory Processing	The perception, analysis and synthesis of patterns among auditory stimuli as well as the discrimination of subtle differences in pattern of sound.
Long-term Storage and Retrieval	The ability to store new or previously acquired information in long-term memory and to retrieve it fluently later through association.
Processing Speed	Performing cognitive tasks fluently and automatically, particularly when under pressure to maintain focused attention and concentration.
Decision/Reaction Time or Speed	The immediacy with which an individual can react to stimuli or a task or the ability to work quickly over a longer period of time.
Reading/Writing	Knowledge of basic reading and writing skills necessary for comprehending written language and expressing thoughts and ideas through writing.

(Flanagan & Orbitz, 2001, p.9-25)

APPENDIX B

DESCRIPTIONS OF THE WJ-III COG SCALES AND SUBTESTS

Scale/Subtest	Definition/Description
Fluid Reasoning	The ability to reason, form concepts and solve problems using unfamiliar information and novel procedures
Concept Formation	A measure of Fluid Reasoning that involves inductive logic in which an individual is presented stimuli in which he/she needs to determine the rule for each item.
Analysis-Synthesis	A measure of Fluid Reasoning that involves deductive reasoning in which an individual is required to reason and draw conclusions based on the given conditions
Comprehension-Knowledge	A measure of one's previously acquired knowledge and one's ability to communicate this information verbally.
Verbal Comprehension	A measure of Comprehension Knowledge that contains four parts: Picture Vocabulary requires an individual to identify pictures of familiar and unfamiliar objects. Synonyms requires an individual to provide a synonym after hearing a word. Antonyms requires an individual to provide an antonym after hearing a word. Verbal Analogies assesses one's ability to reason using word knowledge; requiring an individual to complete a word analogy that is presented.
General Information	A measure of Comprehension Knowledge assessing the depth of one's verbal knowledge.
Short-Term Memory	The ability to perceive, analyze, synthesize and think with visual patterns, including the ability to store and recall visual representations.
Numbers Reversed	A measure of Short-term Memory which requires an individual to hold a span of numbers in memory while reversing the sequence
Memory for Words	A measure of Short-term Memory that requires an individual to repeat a list of unrelated words in the correct sequence.
Visual-Spatial Thinking	The ability to perceive, analyze, synthesize and think with visual patterns, including the ability to store and recall visual representations.
Spatial Relations	A measure of Visual-Spatial Thinking that requires an individual to identify the two or three pieces that form a complete target shape.
Picture Recognition	A measure of Visual-Spatial Thinking that requires an individual to recognize a set of previously presented pictures within a field of distracting pictures.
Auditory Processing	The ability to discriminate, analyze and synthesize auditory stimuli, including the ability to process and discriminate speech sounds that are presented under distorted conditions.

Sound Blending	A measure of Auditory Processing that requires an individual to listen to a series of syllables and then blend the sounds to produce a word.
Auditory Attention	A measure of Auditory Processing that requires and individual to point to a picture after hearing it under distorted conditions.
Long-term Retrieval	The ability to store information and fluently retrieve it later in the process of thinking.
Visual-Auditory Learning	A measure of Long-term Retrieval that requires an individual to learn and recall information that is presented through visual and auditory means.
Retrieval Fluency	A measure of Long-term Retrieval that assesses how fluently one can retrieve previously learned information.
Processing Speed	The ability to perform automatic cognitive tasks, particularly when measured under pressure to maintain focused attention.
Visual Matching	A measure of Processing Speed that requires an individual to locate two identical objects.
Decision Speed	A measure of Processing Speed that requires an individual to quickly locate pictures based on simple concepts.

(Woodcock and Mather, 2001)

APPENDIX C

DESCRIPTIONS OF THE KABC-II SCALES AND SUBTESTS

Scale/Subtest	Description
Sequential/Gsm	The child is presented with a set of stimuli and must reproduce the stimuli in the exact order they were presented.
Number Recall	The child repeats a series of numbers in the same sequence as the examiner said them, with series ranging in length from 2 to 9 numbers.
Word Order	The child touches a series of silhouettes of common objects in the same order as the examiner said the names of the objects; more difficult items include an interference task between the stimulus and response.
Simultaneous/Gv	The child is presented with a problem that includes visual stimuli and requires some type of spatial manipulation and nonverbal reasoning to solve correctly.
Block Counting (ages 13-18)	The child counts the exact number of blocks in various pictures of stacks of blocks. The stacks are configured such that one or more blocks is hidden or partially hidden from view.
Rover (ages 6-18)	The child moves a dog to a bone on the checkerboard-like grid that contains obstacles and tries to find the "quickest" path.
Triangles (ages 3-12)	The child assembles several identical foam triangles (blue on one side, yellow on the other) to match a picture of an abstract design.
Planning/Gf	The child is presented with a novel nonverbal problem, different from the kinds of problems taught in school, and must use verbally mediated reasoning to figure out the correct answer.
Pattern Reasoning	The child is shown a series of stimuli that form a logical, linear pattern, but one stimulus is missing; the child completes the pattern by selecting the correct stimulus from an array of 4 to 6 options at the bottom of the page. Most stimuli are abstract, but some easy items use meaningful pictures.
Story Completion	The child is shown a row of pictures that tell a story, but some of the pictures are missing. The child is given a set of pictures, selects on the ones that are needed to complete the story, and places the missing pictures in their correct locations.
Learning/Glr	The child is taught verbal labels that are paired with visual stimuli and needs to learn these paired associations.

Atlantis	The examiner teaches the child the nonsense names for fanciful pictures of fish, plants, and shells. The child demonstrates learning by pointing to each picture (out of an array of pictures) when it is named.
Rebus	The examiner teaches the child the word or concept associated with each particular rebus (drawing), and the child then "reads" aloud phrases and sentences composed of these rebuses.
Knowledge/Gc (CHC model only)	The child is asked a variety of questions that assess knowledge of words and facts, using a variety of verbal and pictorial stimuli and requiring either verbal (naming) or nonverbal (pointing) responses.
Riddles	The examiner says several characteristics of a concrete or abstract verbal concept, and the child names it.
Verbal Knowledge	The child selects from an array of six pictures the one that illustrates the meaning of a vocabulary word or the answer to a general information prompt.

(Kaufman & Kaufman, 2004)

APPENDIX D

PARENT/GUARDIAN CONSENT FORM

PARENT/GUARDIAN CONSENT FORM

Hello, my name is Jessica Phillips. I am a graduate student from the University of Wisconsin-La Crosse. As part of my graduate program I am doing a research study to learn more about measures of intelligence. I am contacting you to ask you to allow your child to participate in my study by completing two intelligence assessments.

The purpose of my study is to examine the relationship between two tests of intelligence, what they tell us about intelligence and how this information can be applied within the classroom through appropriate classroom interventions. This study is confidential and your child's name will not be released. Your child's participation will involve completing two intelligence assessments that will be administered during two separate meetings which may last up to 1½ hours per meeting. The results of this study may be published in scientific literature or presented at professional meetings using grouped data only and will not include any identifying information of the individuals that completed the assessments.

Your child can withdraw from the study at any time for any reason without penalty. Your child will be compensated for his/her time with $5.00 per meeting. However, children who do not participate in the study do not receive compensation of $5.00. Students and school professionals may benefit by understanding the relationship between intelligence measures and the development of classroom interventions.

Questions regarding study procedures may be directed to the principal researcher, Ms. Jessica Phillips (920-538-3116). Questions may also be directed to the study advisor, Dr. Robert Dixon, Department of School Psychology, University of Wisconsin-La Crosse (608-785-8441).

Questions regarding the protection of human subjects may be addressed to Dr. Bart Van Voorhis, Chair of the University of Wisconsin-La Crosse Institutional Review Board for the Protection of Human Subjects, (608-785-6892).

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* Please fill out this form and return it with your child if you give your permission for your child to participate.

______________________________ __________ ______________________________

Student's Name Grade Homeroom Teacher

I have read the above, have been informed of the nature of this study, and give my permission for my child to participate.

____ __________

Parent /Guardian Signature Date

_____________________________ __________

Researcher

APPENDIX E

ASSENT FORM

ASSENT FORM

I have been told that taking part in this project is voluntary. I have been told that the purpose of my study is look at my answers on two different activities are the same or different. I have been told that I will be paid $5.00 for my time and that there is no penalty for not taking part in this project. I have also been told that if I decide to take part, I can change my mind at any time. I know that my parents are aware that I may be taking part in this project and have given permission for me to be involved.

I have been told that this study is confidential and that my name will be kept separate from my responses.

If you wish to participate, please check yes below, sign your name and return the form to me. If you do not wish to participate, check no below and return the form to me.

______Yes, I would like to participate in this project.

______ No, I do not wish to participate in this project.

________________________________ ________________________________

Print name neatly Signature

____

Date