A LITERATURE REVIEW AND CRITICAL ANALYSIS OF THE CONCURRENT VALIDITY OF THE DIFFERENTIAL ABILITY SCALES AND THE COGNITIVE ASSESSMENT SYSTEM

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Validation studies are a useful tool for comparing the relationship between the
cognitive abilities of intelligence tests. Inferences can be made from the results as to the
degree broad factors from each battery are similar or different in the abilities they measure.
This paper is a review and critical analysis of the literature related to the concurrent
validity between two recently developed intelligence assessments, the Differential Ability
Scales (DAS) and the Cognitive Assessment System (CAS). Topics covered in the
literature review include a consideration of the theoretical constructs associated with both
the DAS and the CAS, and a presentation of the existing validity research regarding each
assessment. The purpose of this paper is to propose a study examining the concurrent
validity of the DAS and the CAS when used with a sample of school-aged children in
regular education programs.
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CHAPTER I

Introduction

Within the realm of the scientific world, the field of psychology has commonly been referred to as a soft science. Outside of Skinnerian behaviorism, psychology generally falls under the criticisms of being overly subjective in its definitions, interpretations and diagnoses. A single concept may be viewed in various ways, using many theoretical viewpoints, and finding a variety of results. No where is this more evident than in the understanding of intelligence. Although intelligence, and the ability to assess it, is considered an important concept in relation to academic settings, a great deal of controversy has surrounded both the ways and means used to define and measure intelligence. With the advent of federal regulations such as the Individuals with Disabilities Education Act (IDEA: 1991, 1997), the need for suitable intelligence tests has never been more important.

Measures of a child’s intellectual abilities are considered one part of what is referred to as the ‘Fours Pillars of Assessment’ (Sattler, 1992). Along with behavioral observations, interviews, and informal assessment, intelligence testing provides an investigator with information into a child’s overall level of functioning, as well as specific abilities. However, intelligence tests provide information about a child’s abilities in two main ways that the other methods do not. First, it provides a standardized or norm-referenced framework (Anastasi & Urbina, 1997). Accordingly, comparisons between individuals, as well as intra-individual performances can be made for the purpose of...
Concurrent Validity of the DAS and CAS placement or identifying special education needs using these tests. Secondly, aptitude has been found to be highly correlated with success in both school and work environments (Sattler, 1992). Being that tests of aptitude have long been considered acceptable ways of predicting future outcomes, they maintain their important place in the educational and psychological landscape.

**Historical Definitions of Intelligence**

Much of the difficulty in developing an adequate intelligence assessment tool is the lack of a consensus definition of what the concept actually represents. Before tasks can be chosen to represent and assess cognitive abilities, those abilities must be operationally defined. Francois (1995) states that in order to make use of what intelligence tests show us, we must first understand what intelligence is. Through the years, the nature of the types of abilities believed to represent intelligence has taken numerous routes. Even the term intelligence itself has recently taken a back seat to a more broad viewpoint involving various cognitive abilities.

Theories of intelligence date back to the origins of psychology (Anastasi & Urbina, 1997). It is believed that ancient Greeks and Chinese used tests as measures of both physical and mental abilities. A heightened focus on defining and assessing intelligence began in the 1800’s as part of attempts to classify between various levels of mental retardation and mental illness using psychological tests (Anastasi & Urbina, 1997). From Francis Galton’s work on sensory perception, to the hierarchical theories of Charles Spearman’s “g” and Horn-Cattell’s multi-factor approach, theories of intelligence have
Concurrent Validity of the DAS and CAS evolved as a science (Drummond, 1996). As these theories have developed over time, tests which measure intelligence have been developed as well.

For the past half century, the assessment of intelligence has been conducted using a small number of tests covering a limited number of abilities. The most recent and commonly heard criticism of the use of these tests, is their lack of being tied to a specific definition or theory of intelligence (Naglieri, 1999). Subsequently, there has been a move away from these traditional measures of intelligence, toward new assessment tools more firmly based upon existing theories of intelligence.

Nearly all involved in the field agree that no single test will measure every aspect of intelligence or every cognitive ability. Nevertheless, by providing, through empirical research, a more accurate definition of which abilities make up intelligence, tests based on those theories will be considered a more accurate means of assessing intelligence. The advent of new theory-based assessments can best be viewed as the next evolutionary step in the process of refining and operationally defining the concept of intelligence.

History of Theory Development

Historically, the variability in the concept and assessment of intelligence has generally followed either one of two paths: one being the psychometric or structural approach and the other pertaining to the theories of information-processing (Sattler, 1992; Harrison, Flanagan, & Genshaft, 1997). The first, and most commonly supported theory in the practice of intelligence assessment is the general factor theory known as ‘g’, originally developed by Spearman in the 1920’s (Francois, 1995). Intelligence under this
ideology is best represented as an overall, broad concept. Greater importance is given to one or a few broad, general abilities as opposed to more narrow bands of specific skills (Elliott, 1990). As an example, for individuals whose performance is based on a broad concept of general intelligence, their performance across other, more specific areas, such as verbal ability, spatial ability, and non-verbal reasoning, would be of lesser interpretive value, if considered at all (Francois, 1995). This concept of intelligence, represented as a single factor “g”, has been applied to most assessment tools currently in use today.

In contrast, during the 1930’s, Thurstone introduced the concept of intelligence being made up of various abilities rather than being a unitary trait (Sattler, 1992; Elliott, 1990). In this theory, each ability, or factor is given equal weight in interpretation. Although his original factors failed to survive the test of time, Thurstone’s theories paved the way for future multi-factor theories. Theories by Guilford, Vernon, and the Horn and Cattell Gf-Gc theory, utilize hierarchical ability levels for which general intelligence (g) itself is of lesser importance, and more significance is given to more specific factors. Broad or general abilities however, are typically interpreted before the specific abilities. The importance of using statistical analysis to support a construct of intelligence, is crucial to these theories. Factor analysis and validity studies are needed to determine which abilities contribute most to cognitive functioning.

More recently, theories concerning the way in which information is processed have been brought into the assessment picture. Originating in the 1960’s, these theories are rooted in research of cognitive functioning as it pertains to patterns of brain functioning.
Concurrent Validity of the DAhS and CAS (Naglieri, 1999). Based largely on the work of Russian neuropsychologist A.R. Luria, the important features of information processing theories are determined by specific structures within the brain that control processing. Variations or deficits in ability levels according to this model, are typically regarded as improper or undeveloped neurological pathways within the brain (Das, Naglieri, & Kirby, 1994).

History of Test Development

Since the work of James McKeen Cattell laid the groundwork for the development of standardized tests back in 1890, the goal of cognitive psychology has been to establish a method of assessing differences in individual cognitive abilities based on empirically sound testing tools. These tools, more commonly referred to as tests of intelligence or IQ tests, have been in use dating back to 1905, when Alfred Binet first published the Binet-Simon Scales of Intelligence (Harrison, et al., 1997). Although similar scales of intelligence were available at the time, the Binet-Simon was the first to provide empirically based results in an unbiased manner (Harrison, et al., 1997). Binet's test was the first to provide a means of predicting academic achievement. However, the Binet-Simon scales gave no indication of how well or poorly a particular child functioned, nor could it differentiate between variance due to age differences (Harrison, et al., 1997). The Stanford-Binet Intelligence Scale was published in 1937, and several revisions later, the Fourth Edition is still in use today.

Following the publishing of the Stanford-Binet, the Wechsler scales of intelligence were introduced. Often considered the most commonly recognized and widely used of the
modern IQ tests, the initial scales were developed over 60 years ago when David Wechsler
adapted individual assessment scales used by the Army into what was then called the
Wechsler-Bellvue Intelligence Scale (Wechsler, 1991). Unlike the Binet scales, Wechsler
believed that intelligence should be assessed in terms of nonverbal as well as verbal
abilities. Although the Wechsler-Bellvue tests were designed to assess the ability of adults,
he published the Wechsler Intelligence Scale for Children (WISC) in 1949 as a means of
competing with the Binet scales (Harrison, et al., 1997). The WISC was followed by the
development of the Wechsler Adult Intelligence Scale (WAIS) in 1955, and the Wechsler
Preschool and Primary Scale of Intelligence (WPPSI) in 1967. Each of the Wechsler scales
have undergone revisions in order to update the norm groups on which the scoring is
based.

Historically, tests of intelligence were designed on the basis of assessing a wide
range of intellectual abilities. They were intended to help predict academic performance
through the testing of skills outside of the typical academic setting. During this period,
intelligence was considered a unitary trait, and was best defined in terms of what a specific
test measured (Ittenbach from Harrison, et al., 1997). Tests such as the original Binet and
Weschler scales had no theoretical basis, but were rather “simply a collection of tasks
divided along verbal and motoric lines” (Ittenbach from Harrison, et al., 1997, p.21). They
did, however, provide an empirical and standardized yardstick for which children’s
intellectual abilities could be compared and classified for purposes of providing proper
educational services at that time.
Criticisms

Both the Binet and Weschler scales were designed to assess individual cognitive functioning and predict whether a particular child would be able to achieve academic success in normal school settings and provided a basis from which to make classifications regarding the specific abilities of individual children. However, these scales, along with intelligence tests in general, have come under a considerable amount of criticism over the past 30 years. Much of the criticism stems from the fact that although these tests have been in use for the past 40 plus years, little has changed in the way they assess cognitive functioning (Harrison, et al., 1997). Despite this, they have been used almost without question as the chief tool in making educational and vocational placement determinations.

Tied into the previous criticism, is the argument that the current IQ tests depend too highly on learned knowledge rather than the ability to learn. There is near consensus among professionals that the ability to acquire knowledge is one of the most important aspects of intelligence, along with abstract thinking and problem-solving ability (Sattler, 1992). However, assessing the ability to acquire knowledge and assessing knowledge previously acquired are very different concepts.

Finally, one of the most relevant criticisms regarding non-theory based assessments is their inability to assess underlying cognitive processes required for successful performance (Sattler, 1992). They focus on intelligence as a general, unitary concept, rather than giving emphasis to specific abilities. As previously noted, these tests were not
designed on a theoretical concept of intelligence, but rather definitions of intelligence were later applied to fit the areas being assessed. In essence, what has evolved from this post hoc method of defining intelligence is what Boring (as cited in Lefrancois, 1995, p. 417) had stated in 1923, “intelligence is what the tests test”.

In response to the criticisms against non-theory based tests, professionals who utilize intelligence tests have begun to develop new and improved methods of assessment based on specific theoretical models of intelligence. Thus, the trend towards more theory based assessment instruments has made its way into the intelligence landscape over the past decade.

*Differential Ability Scales*

The Differential Ability Scales (Elliott, 1990) is a recently developed assessment tool. Although it has been stated that the DAS is guided by a combination of intelligence theories, the interpretive structure is best represented by a collaboration of Carroll’s hierarchical Three Stratum Model, Gf-Gc theory, and Spearman’s “g”. The DAS is designed to provide a measure of general intelligence, as well as for the purpose of diagnosing specific strengths and weaknesses which contribute to overall cognitive functioning (Elliott, 1983).

*Cognitive Assessment System (CAS)*

The Das-Naglieri Cognitive Assessment System (CAS) (Naglieri & Das, 1997) is generally considered a non-traditional measure of intelligence by its authors Jack Naglieri and J.P Das. The theory on which the CAS is based, known as the Planning, Attention,
Simultaneous, and Successive (PASS) theory of cognitive processes, stems from the "merging of both theoretical and applied psychology" (Naglieri & Das, 1997, p. 2), and is largely based on the theoretical concepts originally developed by the neuropsychologist A. R. Luria. The PASS theory is currently considered a cognitive-functioning model of intelligence, in that it is directly connected to how the brain processes information (Harrison, et al., 1997).

**Conclusion**

In comparison to previously developed assessment tools, the new wave of theory-based assessments hold several distinct advantages. Using assessments founded on research-based concepts of intelligence offers examiners the opportunity to provide specific and accurate diagnoses about the nature of an individual’s abilities than tests from earlier periods. Tasks from new assessment methods have been designed in conjunction with skills of academic achievement as a means of developing effective learning interventions. However, it is necessary for current assessments to adhere to statistical analysis as a means of sustaining or declining a proposed theory.

The most acceptable way of assessing an instrument’s legitimate usefulness is through the use of validity studies (Anastasi & Urbina, 1997; Sattler, 1992). Validity studies, as stated in the Standards for Educational and Psychological Testing (American Educational Research Association et al., 1985), are thought of as the ‘most important consideration in test evaluation’ (Drummond, 1996). The intent of conducting validity studies of this nature is to gain a better understanding of how certain tests assess
Concurrent Validity of the DAS and CAS intelligence and whether or not they hold up to the theories they represent. Considerable research on the validity of specific instruments has provided the basis for further understanding and development of intellectual abilities (Sattler, 1992).

Statement of Problem

The purpose of this proposed study is to examine the level of concurrent validity of the Differential Ability Scales (Elliott, 1990) and the Das-Naglieri Cognitive Assessment System (Das & Naglieri, 1996) The research will provide information regarding correlations between scales that claim to measure both similar and different cognitive abilities. It is expected that positive correlations will be found between those factors assessing similar aspects of intelligence. Lower correlations are expected between factors purported to measure different abilities. In the proposed study, the following research questions will be addressed:

Research Questions

R1: This question will examine the strength of the relationship or the amount of correlation between the Cognitive Assessment System’s Full Scale and four cluster scores, with the Differential Ability Scales General Concept Ability and three ability cluster scores. It is expected that modest positive correlations will exist between global and cluster scores assessing similar abilities.

R2: This question will examine the strength of the relationship or the amount of correlation between specific subtest scores from the Cognitive Assessment System
Concurrent Validity of the DAS and CAS and Differential Ability Scales. It is expected that subtests will correlate more significantly with those stated as assessing the same or similar abilities.

Limitations of the Study

The first limitation of this study is that the sample will be taken from a relatively small geographic region. Participants will be recruited from western Wisconsin and the metropolitan Twin Cities area in Minnesota. This means the results of the study may not generalize to children from other geographic regions. Although the study will attempt to contain demographic variables representative of a national sample, participants may be limited in other variables such as economic status and ethnicity. Also, the study will be comprised of only students between the ages of 12-15 and results may not generalize to other age groups. Finally, obtaining a sample size of 30 participants limits the applicability of the results to more global populations. Caution should be used when making assumptions regarding large populations utilizing limited sample sizes.
CHAPTER 2

Review of Literature

This chapter will primarily consist of a review of the relevant research which has been conducted on the Differential Ability Scales (Elliott, 1990) and the Cognitive Assessment System (Naglieri & Das, 1997). The chapter will begin with an overview of the various concepts of validity and its importance in relation to the concept of intelligence testing. The review will then cover relevant psychometric properties of both instruments, including the theoretical constructs on which the tests are based and a review of studies assessing the validation of each instrument. Finally, studies reporting concurrent validity of the DAS and CAS, as well as between the DAS and CAS with other measures of cognitive functioning will be reviewed.

Validity and Its Concepts

Validity refers to “what a test measures and how well it does so” (Anastasi & Urbina, 1997, p.113). The most acceptable way of assessing an instrument’s legitimate usefulness is through the use of validity studies (Anastasi & Urbina, 1997; Sattler, 1992). Validity studies, as stated in the Standards for Educational and Psychological Testing (American Educational Research Association, 1999, p. 9) are thought of as the “most important consideration in test evaluation”. Where as a test’s reliability provides information as to the consistency of the assessment in obtaining its results, validity aims at providing evidence for supporting inferences made regarding the assessment’s “appropriateness, meaningfulness, and usefulness” (American Educational Research Association, 1999, p. 9). It is through the information gained from studies on validity that
we are able to discern what test scores mean. Validity in short is the means of telling whether a certain test is of use in a particular situation. In the case of the current study, validity is used to determine whether the assessments in question are in fact decent means of assessing intellectual abilities.

Validation of an intelligence test generally requires the examination of three principle categories of validity: content validity, construct validity, and criterion-related validity. Within each category, validity can be broken down and assessed in a variety of ways.

Content validity deals with the way in which the test items reflect a specific trait or domain being assessed (Sattler, 1992). Simply stated, this type of validity assesses whether the test items are representative of the content they are intended to measure. Other issues associated with content validity are; whether a test covers enough information to adequately ascertain an interpretation from the test (e.g. the appropriate amount of questions to get accurate data), and whether the items are geared towards the appropriate age or ability level of the test taker. Although content validity is an important part of the validation process, it has little relevance to the current study.

The next measure of validity, known as construct validity or internal validity, refers to whether a test actually measures what it claims to measure. Issues of construct are aimed at measuring specific concepts on which the test is based. In relation to a math test in school, the construct or theory is fairly simple, the test deals with math related problems. Unfortunately, in relation to intellectual assessment, the issue is not as simple. The construct is dependent upon a clearly stated and proven concept of what intelligence
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is. The logic behind conducting studies of construct validity goes towards finding support or disproving the theoretical concepts of an assessment instrument. Anastasi and Urbina (1997, p. 126) define this validation of a test’s theory as “any data throwing light on the nature of the trait under consideration and the conditions affecting its development and manifestations”.

Construct validity can be conducted using various methods, each providing important data about a test. One of the more relevant methods is factor analysis. Factor analysis utilizes a complex mathematical formula which analyzes the relationships between all factors which contribute to a test, and sorts them into a minimum number of traits which contribute to the overall theoretical structure of the test. It breaks apart the various aspects which are considered to make up a general concept, such as intelligence. Sattler (1992, p. 32) simplifies factor analysis by stating that the “major purpose of factor analysis is to simplify the description of behavior by reducing the number of variables to the smallest possible number”.

Within the confines of the current study, factor analytical studies on the DAS and CAS offer data as to how well the statistical constructs match with the theoretical constructs as proposed by the test authors. Knowing how the factors cluster together allows for the development of hypotheses as to the correlation between similar and opposing constructs between the tests.

This leads to another type of construct validity, in which two tests are measured against each other to determine how much correlation there is between certain scales on a particular test (Drummond, 1997). Tests which assess a specific trait or behavior, such as
intelligence or scholastic aptitude, can be compared with new tests of similar constructs, to determine whether the new test correlates well with the existing measure. Tests measuring similar constructs are expected to demonstrate positive correlations, suggesting that both tests measure the same or similar constructs. This is typically known as convergent validity. While convergent validity provides information about similarities between tests, information supporting low correlations between tests with opposing theoretical constructs is equally important. Known as divergent validity, comparisons between variables thought to have an irrelevant relationship are expected to correlate poorly.

Construct validity can also be conducted within the factors of a test itself. Known as internal consistency, this provides a measure for comparing the correlations between the various sub-factors which go into making up the overall or global scale. It is important to understand how much the factors contribute to the overall score, as well as how much each separate factor correlates with each other. This information coincides with the idea of convergent and divergent validity in that it would be expected that sub-factors stated as testing separate abilities would show low levels of correlation. In the same regard, subtests which test similar abilities would be expected to show higher correlations. Tests whose factors do not meet internal construct validity as presented by the test developers can not be considered valid and worthwhile measures of that construct.

The third type of validity is known as criterion-related validity. Research investigating criterion validity is concerned with the accuracy with which test scores are able to predict a specific outcome (American Educational Research Association, 1985).
Criterion-related validity utilizes the information gained from studies of construct validity. Although seemingly similar, criterion-related validity differs from construct validity in that construct validity looks for correlations that are similar but to a lesser degree than is expected using criterion-related validity. Criterion-related validity works under the premise that similar concepts or theories, such as intelligence, should correlate strongly with one another. In other words, they would display strong convergent validity because they would be expected to assess the same criterion. By statistically measuring a new theoretical construct against a previously accepted one, the resulting correlation provides evidence as to the degree the new construct supports its proposed theory. In other words, "the higher the correlation ... the higher is its criterion-related validity" (Thorndike, 1997, p. 143), and the better that instrument is at predicting an outcome.

Criterion validity can be differentiated into two types, concurrent and predictive. Anastasi and Urbina (1997) offer a clear explanation of predictive validity, stating it is a form of criterion-referenced validity that looks at how effectively a test works to predict individual performance in a specific activity or ability. A predictive study is best understood in terms of the timing of the comparison. Simply stated, predictive validity looks at how well previously obtained test data can estimate results obtained in the future. As an example, for an intelligence test to be considered valid, it needs to be able to accurately predict future academic performance. Predictive validity assesses the degree to which an instrument does this.

This study focuses on the type of criterion-referenced validity known as concurrent validity. Concurrent validity is defined by Sattler (1992, p.30), as "whether test scores are
related to some currently available criterion measure.” Concurrent validity differs from predictive validity in that it assesses scores taken essentially at the same time (Drummond, 1996; Thorndike, 1997). Resulting correlations reflect the degree to which the stated criterion of each instrument match. In this sense, a concurrent study provides both concurrent and predictive information (American Educational Research Association, 1985).

In the case of this study, the criterion measures are the specific cognitive abilities, which each instrument claims to assess. Data from this study will provide information as to whether these tests can both be considered overall measures of cognitive abilities or whether they are in fact assessing factors that are less directly related to intelligence. Concurrent studies are important in that they provide information which either support or challenge an instrument’s underlying theory. Because both the CAS and DAS offer global, as well as sub-factor scores, comparisons can be made among the various factors available.

Differential Ability Scales (DAS)

Spurred on by Piagetian developmental psychology, and the lack of diagnostic utility of previous assessment tools, Colin Elliott set out to develop an instrument assessing a wider range of cognitive abilities (Elliott, 1990). He developed the Differential Ability Scales (DAS) (Elliott, 1990) based on his British Ability Scales developed nearly a decade previously. The DAS is considered a “revision and extension of the BAS” (Elliott, 1990, p. 31). Elliott’s (1983) development of the DAS involved two decades of research on current theories of intellectual abilities.
The DAS has at its foremost interpretive level an overall intelligence factor, referred to as the General Conceptual Ability factor or GCA. Making up the global score are three major ability clusters consisting of Verbal (Gc), Spatial (Gv), and Nonverbal Reasoning (Gf) abilities. Elliott (1990, p. 185) states that while other factors which influence general intelligence exist, “the three that have the greatest contribution to defining g are the Gf, Gv, and Gc factors”. Verbal abilities are based on the crystallized intelligence factor of the Horn-Cattell model (Elliott, 1990). Spatial abilities are associated with Horn-Cattell’s visual processing ability (Elliott, 1990). Finally, the Nonverbal Reasoning cluster is based on the concept of fluid intelligence (Elliott, 1990).

In designing the DAS, Elliott’s main goal was to move away from the method of matching post hoc a theoretical construct to the abilities which are measured by the instrument. By combining both broad and narrow ability factors into one assessment, Elliott (1983) allowed for various interpretive techniques to be applied to the DAS. Harrison, et al., (1997) cites research which supports using an integrated Horn-Cattell/Carroll Gf-Gc model (referred to as the CHC model) in developing assessments of intelligence. However, a common criticism of the DAS is that it only measures a portion of the abilities outlined in the theories of Horn-Cattell and Carroll (Harrison, et al., 1997). Anastasi and Urbina (1997) however, support the DAS’s strong theoretical foundation and empirical basis as a vast improvement over previously used assessments.

**DAS Theoretical Constructs**

Colin Elliott’s (1990) Differential Ability Scales (DAS) is the result of a type of intellectual evolutionary process from which concepts of cognitive abilities are defined,
The aim is to increase the assessment’s usefulness as a diagnostic tool through solid empirical scrutiny. Unlike previous tests of general abilities, the DAS is designed to test specific abilities, statistically shown to be highly involved in cognitive functioning.

As previously stated, the developer of the DAS identifies the test’s theoretical background to represent various models including those associated with neuropsychology. However, the best representative model of the DAS is actually an integration of the Horn-Cattell Gf-Gc theory, with Carroll’s Three-Stratum Model, with Spearman’s “g” representing the overall intelligence factor (Thorndike, 1997). Harrison, et al., (1997) notes that numerous important similarities exist between these theories. In fact, Burns (as cited in Harrison, et al., 1997), states Carroll’s adaptations of Horn-Cattell’s theory of various cognitive abilities is thought to be one of the most important models of intellectual functioning in decades. Before delving into the specific concepts which are represented by the DAS, it is important to take some time to understand the theoretical evolution which led to the foundation of the previously mentioned theories and the eventual development of Elliott’s (1990) Differential Ability Scales.

Although the DAS mostly utilizes research conducted within the past 20 or so years, the origins of the current theories began in the first half of the twentieth century. As a branching off from Spearman’s original psychometric theories of general intelligence (‘g’), Thurstone (1938) was the first to introduce the concept of intelligence in terms of various abilities. With the introduction of statistical analysis, Vernon (1950) factor analyzed Thurstone’s abilities which he condensed into two main groupings of factors that
best represented an individual’s cognitive abilities. Using these factors, Vernon developed a hierarchical model of intelligence consisting of both primary and secondary abilities which could be presented in terms of an overall intelligence factor (Elliott, 1983). Although Vernon’s verbal and spatial factors were later replaced by the crystallized and fluid factors defined by Horn and Cattell, the groundwork was laid for assessing intelligence through multiple factors.

Frequently considered the “most comprehensive and empirically supported psychometric theory of intelligence” (Harrison, et al., 1997, p, 8), Gf-Gc theory provided the basis for the development of a new wave of psychometrically based intellectual assessment tools. Originally proposed by James McKeen Cattell in 1943, it wasn’t until the 1960’s when in collaboration with John Horn, that the Gf-Gc theory was formed (Thorndike, 1997). Initially, only crystallized and fluid abilities were identified as the two main factors influencing intelligence. Various other abilities have since been derived through statistical analysis of numerous assessment batteries (Thorndike, 1997). The following is a brief categorization of the abilities as discerned through the Horn-Cattell model.

As the first identified ability, fluid intelligence (Gf) is defined by Thorndike (1997, p.223) “as a problem-solving and information processing ability that is largely independent of experience”. Relying on the ability to conceptualize and process novel information in unfamiliar ways is generally associated with the ability to learn and develop new skills. Taylor (as cited in Harrison, et al., 1997) adds that fluid intelligence includes both inductive and deductive reasoning. Much the opposite, crystallized intelligence (Gc) is
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typically defined in terms of assessing an individual’s ability to express previously learned knowledge. In contrast to fluid intelligence, tests of crystallized intelligence often require utilization of other abilities such as memory, and are often considered the end result of previously used fluid abilities (Harrison, et al., 1997).

Another ability as derived through the Gf-Gc model on which the DAS relies heavily is referred to as Visualization Processing (Gv) (Elliott, 1990). Gv refers to the ability to perceive, analyze, manipulate, and form concepts about various visual-spatial relationships (Harrison, et al., 1997; Thorndike, 1997). Other abilities included within the DAS are short (Gsm) and long term (Glr) memory, and the ability to process information quickly (Gs). These abilities, which are less correlated with general cognitive abilities, are included as part of the diagnostic subtests on the DAS.

The role Carroll’s theory plays in the development of the DAS, has more to do with the use of its hierarchical structure of interpretation, than with specific abilities themselves. In using the Horn-Cattell Gf-Gc model, there is little differentiation between how factors influence general intelligence, relying only on the broad level of abilities which vary little in their interpretive use. Carroll’s factor analysis of assessment batteries suggested that not only are there significantly more broad abilities influencing intelligence (69 to be exact), but that the relations between abilities could be combined towards a general level of intelligence or “g” (Harrison, et al., 1997). His theory introduced what he termed three stratum of abilities which were hierarchical in nature, meaning the most broadly defined abilities were those most highly correlated with “g“, while the most narrow abilities have lesser influence on intelligence. Overall, Carroll’s Stratum II, broad
abilities, consist mostly of those abilities defined by the Horn-Cattell model, as they correlate strongest with general intelligence. In developing the DAS, Elliott (1990) applies this Three Stratum model, with Stratum I being overall “g,” Stratum II being the cluster abilities which include spatial ability, non-verbal ability, and verbal ability, and Stratum III which is comprised of the narrow band abilities associated with each subtest.

With overall general intelligence “g”, as its foremost means of interpretation, the DAS reflects the integrated Gf-Gc/Three Stratum model and allows for interpretation of abilities ranging from those most strongly associated with “g” to those further along the spectrum. Within each level of ability, meaning either narrow, broad or overall intelligence, the factors follow progressive levels of inter-correlations, which allow for interpretations to be made as the factors narrow (Harrison, et al., 1997). For example, the narrow band abilities have small but positive correlations among each other. This works on two interpretive levels, the first of which is that each is individually assessing a different aspect of intelligence, and therefore is interpretable on its own. Conversely, the culmination of these small correlations support estimations being deduced about the more broad Stratum II factors. Finally, these broad factors show an increased positive correlation among themselves, resulting in the general intelligence factor (g) being the best representation of an individual’s cognitive abilities.

Construct Validity of the DAS

The technical manual of the Differential Abilities Scale (Elliott, 1990), cites several studies of Confirmatory Factor Analysis, which support the hierarchical, three-factor model proposed by the author. Data suggests that as the age of the individual increases,
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abilities contributing to intelligence become more differentiated. As the cognitive ability of
the individual increases, the number of significant factors contributing to general
intelligence increases as well, reaching a plateau of three factors. According to Elliott
(1990), although both one factor and two factor (verbal-nonverbal ability) models fit
reasonably well with the DAS, the three factor model (verbal, nonverbal, and spatial
ability) was statistically the best fit, improving as the age of the examinee increased. As
expected, diagnostic subtests were shown to contribute less to factors of general
intelligence, supporting them as being more independent cognitive abilities.

Support for the hierarchical three-factor model of the DAS can be found in an
independent study by Keith (1990), whose results were similar to those presented in the
DAS technical manual (Elliott, 1990). Results from this study suggest that the DAS Verbal
Ability factor reflects crystallized intelligence, the DAS Non-Verbal Reasoning cluster
indicates fluid intelligence, and the DAS Spatial Cluster reflects nonverbal reasoning
ability. Keith (1990), also found data to support the differentiation between the diagnostic
and the core battery subtests. Subtests from the core battery loaded higher with the
general clusters related to intelligence, whereas, diagnostic subtests were considered to
represent more independent abilities, having lesser correlations with the general factor
clusters.

Another independent analysis of the DAS factors was conducted by Byrd and
Buckhalt (1991). Their confirmatory factor analytic study between factors on the DAS
and the WISC-R (Weschler, 1974), provided support for a hierarchical model of DAS.
The study suggested that not only did the DAS measure broad constructs related to other
Concurrent Validity of the DAS and CAS

assessment tools, it measured distinctive narrow abilities, novel from other intelligence tests. A similar study by Stone (1992), comparing the DAS with the WISC-R, found that the DAS fit best with the three-factor hierarchical model proposed in the technical manual (Elliott, 1990). According to this study, the DAS core subtests represent Verbal Ability, Nonverbal Reasoning Ability, and Spatial Ability, with the diagnostic subtests separating into the narrow factors of Numeric Ability and Processing Speed.

Finally, as part of a study on the efficacy of using the DAS to make learning disability determinations, Shapiro, Buckhalt, and Herod (1995) found support for the construct validity of the DAS. The results were consistent with previous studies by Keith (1990) and Stone (1992), in which the Verbal Ability and Spatial Ability composites were strongly supported, but weaker correlations were found for the Nonverbal Reasoning Ability cluster.

A study by Parker (1996), using a school-aged sample of mentally handicapped students failed to support the three factor DAS model. The data from this study found that the Verbal Ability, Nonverbal Reasoning Ability, and Spatial Ability clusters did not differentiate from one another. In contrast, the results suggest using a single-factor model for interpreting the cognitive abilities of mentally handicapped children using the DAS.

Concurrent Validity of the DAS

The DAS technical manual (Elliott, 1990) cites several studies in which evidence for concurrent validity is provided. In relation to the school-aged battery, the DAS is compared with the Weschler Intelligence Scale for Children-Third Edition (WISC-III; Weschler, 1991), the Stanford-Binet Fourth Edition (SB-IV; Thorndike, Hagan, & Sattler,
Concurrent Validity of the DAS and CAS

1986), and the Kaufman Assessment Battery for Children (K-ABC; Kaufman & Kaufman, 1985). Correlations between the DAS, the SB-IV, the K-ABC, and the WISC-III are presented in Tables 2.1, 2.2, and 2.3.

Table 2.1

*Correlations and mean scores between the DAS and the SB-IV broad and cluster scores*

<table>
<thead>
<tr>
<th>SB-IV</th>
<th>Verbal Ability</th>
<th>Nonverbal Reasoning Ability</th>
<th>Spatial Ability</th>
<th>GCA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal Reasoning</td>
<td>.79</td>
<td>.58</td>
<td>.37</td>
<td>.73</td>
</tr>
<tr>
<td>Abstract-Visual Reasoning</td>
<td>.44</td>
<td>.76</td>
<td>.67</td>
<td>.77</td>
</tr>
<tr>
<td>Quant. Reasoning</td>
<td>.63</td>
<td>.75</td>
<td>.46</td>
<td>.76</td>
</tr>
<tr>
<td>Short-Term Memory</td>
<td>.50</td>
<td>.55</td>
<td>.42</td>
<td>.61</td>
</tr>
<tr>
<td>Standard Area Score (SAS)</td>
<td>.73</td>
<td>.82</td>
<td>.60</td>
<td>.88</td>
</tr>
</tbody>
</table>

Table 2.2

*Correlations between the DAS and the K-ABC broad and cluster scores*

<table>
<thead>
<tr>
<th>K-ABC</th>
<th>Verbal Ability</th>
<th>Nonverbal Reasoning Ability</th>
<th>Spatial Ability</th>
<th>GCA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sequential Processing</td>
<td>.18</td>
<td>.24</td>
<td>.62</td>
<td>.46</td>
</tr>
<tr>
<td>Simultaneous Processing</td>
<td>.35</td>
<td>.68</td>
<td>.74</td>
<td>.78</td>
</tr>
<tr>
<td>Mental Processing Composite</td>
<td>.32</td>
<td>.56</td>
<td>.81</td>
<td>.75</td>
</tr>
<tr>
<td>Achievement</td>
<td>.64</td>
<td>.72</td>
<td>.39</td>
<td>.78</td>
</tr>
</tbody>
</table>
Table 2.3

*Correlations between the DAS and the WISC-III broad and cluster scores*

<table>
<thead>
<tr>
<th></th>
<th>DAS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Verbal Ability</td>
</tr>
<tr>
<td>WISC-III</td>
<td></td>
</tr>
<tr>
<td>Verbal IQ</td>
<td>.87</td>
</tr>
<tr>
<td>Performance IQ</td>
<td>.31</td>
</tr>
<tr>
<td>Full Scale IQ</td>
<td>.71</td>
</tr>
<tr>
<td>Verbal Comp. Index (VC)</td>
<td>.85</td>
</tr>
<tr>
<td>Perceptual Organ. Index (PO)</td>
<td>.30</td>
</tr>
<tr>
<td>Freedom from Distract. Index</td>
<td>.66</td>
</tr>
<tr>
<td>Processing Speed Index (PS)</td>
<td>.29</td>
</tr>
</tbody>
</table>

In comparison to the broad scores of other intelligence tools, research indicates that the GCA of the DAS correlates strongly with other broad measures of intelligence.

Among the assessments cited in the DAS manual, both the WISC-III Full Scale IQ (.92) and the Standard Area Score of the SB-IV (.88), were found to be highly correlated with the DAS’s GCA, indicating that there are similar abilities being measured by each battery.

Likewise, the Mental Processing Composite of the K-ABC (.75) was similar in comparison to the GCA of the DAS. Reports of mean score differences between the DAS, the WISC-III, and the SB-IV were found to be non-significant.

Among the studies provided in the DAS manual, comparisons between the DAS cluster scores and cluster scores from the SB-IV, the WISC-III, and the K-ABC batteries, provide support for both convergent and divergent validity. The DAS Verbal Ability
Concurrent validity of the DAS and CAS

The studies provided support for the convergent validity of the Nonverbal Reasoning cluster as well. Correlations between the Nonverbal Reasoning cluster of the DAS and cluster scores on the SB-IV were highest for the Abstract-Visual and Quantitative Reasoning clusters (.76 and .75 respectively). Only moderate correlations were indicated between the DAS Nonverbal Reasoning cluster and the SB-IV Verbal Reasoning and Short-Term Memory clusters (.58 and .55). In the same way, relatively
high correlations between the DAS Nonverbal Reasoning cluster and both the WISC-III Performance Scale IQ score and Perceptual Organization cluster were shown, while the Verbal Scale IQ score and Verbal Comprehension cluster were only modestly correlated (.58 and .54). Likewise, strong correlations were found between the DAS Nonverbal Reasoning cluster and both the Achievement and Simultaneous Processing cluster of the K-ABC (.72 and .68). Conversely, the K-ABC Sequential Processing scale only showed a .24 correlation with the DAS Nonverbal Reasoning cluster. These studies suggest that the DAS Nonverbal Reasoning cluster has strong convergent validity with measures assessing similar proposed abilities and is able to discriminate between dissimilar abilities.

The DAS Spatial Ability cluster is considered most associated with measures of visual-spatial reasoning and perceptual organization (Elliott, 1990). In accordance, this cluster correlates most strongly with both the Performance Scale IQ score and Perceptual Organization cluster from the WISC-III (.82 and .82), as well as the Simultaneous Processing cluster of the K-ABC (.74). Cluster scores found to have moderate correlations with the DAS Spatial Ability cluster include Abstract-Visual Reasoning from the SB-IV (.67), Sequential Processing from the K-ABC (.62), and both the Verbal Scale IQ score and the Verbal Comprehension cluster from the WISC-III (.66 and .66). These results indicate measures of sequential processing, verbal comprehension, and visual-spatial ability are being assessed through the DAS Spatial Ability cluster.

An independent study by Dumont, Cruse, Price, and Whelley, (1996), used a group of learning disabled students to compare the concurrent validity between the DAS and the WISC-III. They found support for the concurrent validity of the DAS. A strong
Concurrent validity of the DAS and CAS 29

correlation was reported between the DAS GCA and the WISC-III Full Scale IQ score. This suggests that the DAS is a good measure of general intelligence. Likewise, strong correlations were found between cluster scores which were assumed to measure similar abilities. The DAS Verbal Ability cluster correlated highest with the Verbal Scale IQ score and Verbal Comprehension cluster of the WISC-III (.77), indicating that subtests making up the DAS Verbal Ability cluster, are in fact good measures of verbal ability and crystallized intelligence. Both the Spatial Ability (.67 and .66) and Nonverbal Reasoning (.65 and .63) clusters of the DAS correlated most significantly with the WISC-III Performance Scale IQ score and Perceptual Organization cluster, suggesting similar abilities being measured between the DAS and WISC-III on these scales.

Of the DAS core battery subtests, none were found to be strong measures of processing speed, when compared to subtests comprising the WISC-III Processing Speed cluster. Moderate correlations, ranging from .42 to .59 were found between the WISC-III Freedom from Distractibility cluster and each of the DAS composites. Each of the DAS diagnostic subtests had low correlations with the Full Scale IQ score and cluster scores of the WISC-III, suggesting that they are peripheral measures of intellectual ability. The grouping of cluster scores on the DAS with comparable measures on the WISC-III provides support for the convergent and divergent validity of the DAS model. The results from this study are presented in table 2.4.
Table 2.4

*Correlations between the DAS and the WISC-III broad and cluster scores with a group of learning disabled students*

<table>
<thead>
<tr>
<th></th>
<th>DAS</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Verbal</td>
<td>Nonverbal</td>
<td>Spatial</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ability</td>
<td>Reasoning</td>
<td>Ability</td>
</tr>
<tr>
<td>WISC-III</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verbal IQ</td>
<td>.77</td>
<td>.55</td>
<td>.50</td>
<td>.68</td>
</tr>
<tr>
<td>Performance IQ</td>
<td>.52</td>
<td>.65</td>
<td>.67</td>
<td>.71</td>
</tr>
<tr>
<td>Full Scale IQ</td>
<td>.72</td>
<td>.67</td>
<td>.64</td>
<td>.78</td>
</tr>
<tr>
<td>Verbal Comp. Index (VC)</td>
<td>.75</td>
<td>.50</td>
<td>.47</td>
<td>.65</td>
</tr>
<tr>
<td>Perceptual Organ. Index (PO)</td>
<td>.60</td>
<td>.63</td>
<td>.66</td>
<td>.73</td>
</tr>
<tr>
<td>Freedom from Distract. Index</td>
<td>.59</td>
<td>.53</td>
<td>.42</td>
<td>.58</td>
</tr>
<tr>
<td>Processing Speed Index (PS)</td>
<td>-.05</td>
<td>.31</td>
<td>.12</td>
<td>.13</td>
</tr>
</tbody>
</table>

*Cognitive Assessment System (CAS)*

Theories related to information processing in regards to intelligence testing were first introduced in the early 1970's as part of the Kaufman Assessment Battery for Children (Kaufman & Kaufman, 1983). The methods of processing assessed on the K-ABC emphasized problem solving in terms of either identifying the serial or temporal order of stimuli, or understanding and integrating information using a spatial orientation (Kaufman & Kaufman, 1983). Consistent with the information-processing model, tests on the K-ABC were designed to minimize the effects of language, so as to be used with more diverse populations.

Since then, few scales have been designed utilizing the information processing
model, until the development of the CAS. The development of the CAS was in large part due to information from neuropsychological research indicating a strong positive correlation with information processing theory, intelligence and academic achievement (Anastasi & Urbina, 1997). J.P. Das and Jack Naglieri utilized theoretical research from both cognitive psychology and neuropsychology, to structure their information-processing theory into the Planning, Attention, Successive, and Simultaneous (PASS) Theory of Intelligence (Das et al., 1994) on which the CAS was based. The authors of the PASS model consider it to be a re-conceptualized way of looking at the “essential elements of human cognitive functioning” (Das & Naglieri, 1997, p. 2). The following section provides the theoretical background needed to understand the development and interpretation of the CAS.

**CAS Theoretical Constructs**

Based primarily on A.R. Luria’s neuropsychological model of brain processing, the CAS has adapted Luria’s theories into what is known as an information processing model (Thorndike, 1997). According to Luria, intelligence can be described as “distinctive functional systems” guiding individual cognitive processes, which are linked to specific regions of the brain (Naglieri, 1999). Luria identified three systems of cognitive processing which work together to encompass all ‘necessary mental activity’(Kirby, Das, & Naglieri, 1994, p.13). These systems include the regulation and maintenance of attention; the receiving, processing, storing and coding of information; and the regulation and direction of mental activity (Das et al., 1994). Simply stated, according to this theory, an individual’s level of intelligence or cognitive functioning, is determined by these three
Concurrent Validity of the DAS and CAS

Each system, while able to be identified individually, works in a related manner, and contributes to overall cognitive functioning. Because of this, the information-processing model allows for important interpretations to be made at various levels. Each system is considered to be distinct and therefore interpretable independently. However, the inter-relatedness of each system allows for an interpretation to be derived regarding overall cognitive functioning.

While the information-processing model contains aspects reflecting other theories of cognitive abilities, its focus is more towards how the process of problem solving is affected by the input of information (Hergenhahn & Olson, 1997). It is focused on the strategies which are developed and whether these strategies help or hinder one's ability to learn new information, rather than the specific abilities which a task may assess. These strategies are described as “conscious plans for performing tasks” (Das et al., 1994, p. 10), which are involved in organizing specific abilities. While the specific abilities associated with intelligence may interact, the systems or processes are “dynamic and controllable” (Das et al., 1994, p. 9), lending themselves to being modified through integrating appropriate strategies. Information-processing works under the construct of examining the processes that go into certain abilities rather than the abilities themselves, therefore making assessments based on its theories more conducive to academic interventions (Das et al., 1994).

Information-processing theory differs from ability theories in that it aims to explain what causes a task to be performed either correctly or incorrectly. Developing correct
strategies is thought to be considered necessary for learning. According to this theory, successful processing requires a balance between the systems of processing and an individual’s acquired knowledge base. Considered the “cumulative result of a person’s experience stored in memory” (Das et al., 1994, p.19), this knowledge base influences all areas of cognition. Because experience and environment are believed to play a significant role in the development of problem solving skills (Hergenhahn & Olson, 1997), processing strategies are thought to be modifiable through teaching and intervention.

As possibly its foremost characteristic, the information-processing theory relies on the concept that performance is not a solitary construct. Although intellectual ability typically remains stable throughout life, processing can be enhanced through learned strategies (Das et al., 1994). The focus of this concept is that problem solving skills, regardless of specific ability (i.e. Gf, Gc, etc.) can improve with proper experience. This concept is similar to the phenomenon known as practice effects, which can occur on many intellectual assessments. Once the proper strategy is learned, the task becomes easier to solve, regardless of the difficulty or complexity of the problem.

The PASS model integrates Luria’s three systems of cognitive functioning. Although this theory states that it is necessary for these systems to work together, they each perform specific functions that are believed to be individually identifiable. While the information-processing model designates three specific systems, planning, processing, and attention, the PASS model breaks apart the information processing system into two distinct systems, Successive and Simultaneous processing. All told, the PASS theory on which the CAS is based, consists of four areas of cognitive functioning: Planning,
Attention, Successive Processing, and Simultaneous Processing. According to the developers of the PASS theory, each area can be assessed individually based on specific properties pertaining to each. They claim that each scale is a functional unit of cognitive ability with distinct and measurable qualities. In order to comprehend these claims, we must first look at the what each area is attempting to measure.

**Planning**

In relation to Luria’s original systems, planning refers to the regulation and control of other mental processes. According to Naglieri (1997, p. 12), the planning process “provides the means to solve problems of varying complexity”. He describes the mental processes involved as those “by which the individual selects, applies, and evaluates solutions to problems” (Naglieri & Das, 1997, p.2) Successful planning ability involves being able to develop plans of action, evaluate and monitor the plan’s effectiveness, and make a decision as whether to alter or reject the plan. Planning processes are considered necessary to understand 'how' to do something as opposed to simply knowing what is to be done. Someone with sufficient planning skills will be able to solve a variety of novel problems for which there is no immediate solution, by utilizing and modifying previously learned strategies. It can include both simple and complex tasks and may involve processes from each of the other areas. Overall, planning is considered essential in controlling and regulating all intentional or voluntary activity.

**Attention**

Attention involves “allowing the individual to respond to a particular stimulus and inhibit responding to competing stimuli” (Harrison, et al., 1997, p. 249). In other words,
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tasks assessing attention require the individual to focus on a specific item while being able to ignore similar but inappropriate items within a problem. Attention on the CAS is defined in two ways: Selective attention and Sustained attention.

Selective attention is looked at in terms of either focused or divided attention. Focused attention refers to an individual’s ability to initially direct their attention towards a particular task. This simply involves an individual being able to concentrate on a specific activity, with the individual being able to direct that focus towards one source of information while excluding others. Divided attention looks at the ability to share attention between two or more sources. Naglieri (1999) separates divided attention into two components, expressive and receptive attention, which can be assessed individually from one another.

The two aspects distinguish between attention in terms of the ability to express information versus the ability to receive or encode information. Expressive attention refers to the ability to suppress automatic responses to familiar stimuli and determine between possible discrepancies. For example, an individual’s ability to state the names of colors which are written in a different color, requires expressive attention skills. Receptive skills involve being able to distinguish between stimuli from related tasks such as in dichotic listening, name-matching, or incidental learning. An example of receptive attention is found with Posner’s (as cited in Das et al., 1994) physical and name match tasks, which require the individual to pair up letters or pictures based on their being either physically the same (such as two different pictures of cars) or having the same name (such as matching the same upper or lower case letters). This task breaks down selective attention
even further in that tasks of physical matching are thought to be data driven, whereas tasks of naming or categorization are thought to be memory driven.

Parasuraman (1984) defines sustained attention as vigilance or the ability to maintain focus over time. This aspect of attention most closely reflects the ability to maintain arousal of cognitive ability regardless of increasingly similar competing stimuli. Das and Naglieri (1997) define this extended state of cognitive awareness in terms of the brain being efficient. This means that those with higher cognitive attention ability, will require less expenditure of cognitive activity in order to perform attention tasks correctly. Sustained focus is considered to be strongly associated with tasks involved in achieving at school.

**Simultaneous Processing**

Luria defined simultaneous processing as “the mental process by which the individual integrates separate stimuli into a single whole or group” (Naglieri, & Das, 1997, p.4). The essential aspect of simultaneous processing is the ability to recognize how separate elements or stimuli are inter-related. Tasks of this type are highly grounded in “spatial and logical dimensions for both verbal and non-verbal content” (Naglieri, 1999, p. 17). The goal of simultaneous tasks is to determine an overall concept or gestalt of a stimulus based on logical relationships between individual parts.

**Successive Processing**

Naglieri and Das (1997, p.5) define successive processing as those “mental processes by which the individual integrates stimuli into a specific serial order that forms a chain-like progression”. Solving tasks of succession involves identifying the relationship
between objects, recognizing the order they must follow, and finding the sequence which appears most logical. It is important to note that in successive processing, each element is related only to the preceding one. In no situation are elements inter-related.

Successive processing can be delineated into serial and syntactic components. However, these components are used together in solving successive tasks. Serial components are those which demand correct ordering of information. It involves “both the perception of stimuli in sequence and the formation of sounds and movements in order” (Naglieri & Das, 1997, p. 6). In other words, accurate completion of serial tasks requires the correct sequence of thought and physical action, such as correctly pronouncing words in a sentence. Syntactic processing involves being able to comprehend narrative speech based on the accurate sequencing of information.

**Construct Validity of the CAS**

The Cognitive Assessment System technical manual (Naglieri, 1997) offers confirmatory factor analysis studies which support the four-factor PASS model of the CAS. Moderate support is also offered for a three-factor model in which the Planning and Attention clusters combine to form one ability. Using the standard battery subtests on a school-aged sample, Naglieri (1997) found that the PASS model was the best fit across several age groups, producing correlations in the .80 and .90 range across factors. It is important to note that these factors do not follow a hierarchical progression, but rather load equally as assessing individual and separate abilities. Correlations performed looking at a one-factor, general intelligence model, were substantially lower than either the four or three factor model. This information supports using the individual CAS factors as
Concurrent Validity of the DAS and CAS

measures of independent cognitive abilities.

In an independent confirmatory factor analysis of the CAS and PASS model constructs, Kranzler and Weng (1995) failed to support the PASS model as proposed in the technical manual. Their data suggests that the CAS constructs are best interpreted in terms of either a hierarchical general intelligence model, similar to that of the CHC model or a revised PASS model in which the Planning and Attention factors are combined. Furthermore, the data suggested that the CAS is better represented by a factor of general intelligence, as opposed to the individual abilities of the PASS model. Of the two alternative models presented, the revised three factor (PA)SS model was found to be the best method of interpreting the CAS.

Further evidence opposing the theoretical constructs of the PASS model is presented in a study by Kranzler and Keith (1999). Their data suggested that the CAS constructs were best represented through an integrated hierarchical model, similar to Carroll’s three-stratum theory, with general intelligence being its most broad measure. Of the original PASS factors, only the successive processing factor was found to be interpretable individually. Other factors including attention and planning, grouped into a measure of processing speed. In contrast, the correlated PASS model used by Naglieri (1997) provided only a modest fit to the data. The study did however, support the CAS constructs as assessing consistent abilities across age groups. The results of this study support the use of the CAS as a measure of general intelligence and various broad abilities associated with intelligence. It does not however, support use of the CAS for assessing specific strengths and weaknesses in academic settings.
As a response to the Kranzler and Keith's study (1999), Naglieri (1999) presented evidence which supported the construct validity of the PASS model. In particular, Naglieri criticized the interpretation of the CAS attention and planning constructs as singularly a measure of processing speed, finding rather, that these scales do in fact assess specific cognitive abilities which can be differentiated between themselves and other abilities (Naglieri, 1999). Overall, the study determined that the PASS model is in fact a better interpretive model than the integrated hierarchical model proposed by Kranzler and Keith (1999), and that the theoretical constructs proposed by the CAS technical manual assess distinct and individually interpretable abilities.

However, Naglieri down played the role of using confirmatory factor analysis to determine whether an assessment meets construct validity. As a follow-up to their original study, Keith and Kranzler (1999) responded to Naglieri's (1999) study, stating that factor analysis is an essential and productive means of making determinations regarding a test's construct validity. Furthermore, they provided evidence suggesting that the CAS lacks sufficient structural fidelity, a necessary component of construct validity. Finally, they again found evidence which stated that the correlated PASS model does not offer the best statistical fit. Similar to their previous study, Keith and Kranzler (1999) found that three of the four PASS constructs did not show enough specificity for interpretation, with the attention and planning factors being nearly indistinguishable from one another.

The most recent investigation into the construct validity of the CAS was done by Keith, Kranzler, and Flanagan (2000), in study yet to be published. The results of factor analysis again failed to support the theoretical constructs of the CAS and the PASS model.
In contrast, the study supported applying a hierarchical Carroll-Horn-Cattell model to the CAS and determined that the CAS Full Scale factor was indeed a measure of general intelligence, similar to other intelligence assessments. These results suggest that the CAS does not measure unique abilities as the PASS model proposes, but rather follows the lines of more traditional measures of intelligence.

Concurrent Validity of the CAS

Currently, only one study evaluating the concurrent validity of the CAS has been published. This study, cited in the CAS technical manual (Naglieri, 1997), compares the PASS model factors of the CAS to the general intelligence and broad cluster scales of the WISC-III (Weschler, 1991). The study includes regular education, mentally handicapped, and learning disabled students, however in reference to the current study, only the results from regular education students will be discussed. Correlations between the CAS and WISC-III are reported in Table 2.5.

Data presented in the CAS technical manual (Naglieri, 1997) support using the correlated PASS model for interpretation of the CAS factor scales. Because factors on the CAS are inter-related, but believed to assess dissimilar abilities, it would be expected that modest correlations between similar factors, such as Planning and Attention would be indicated. This hypothesis is supported by the concurrent validity study cited in the CAS technical manual (Naglieri, 1997).
Table 2.5

_Correlations between the CAS and WISC-III broad and cluster scores_

<table>
<thead>
<tr>
<th></th>
<th>CAS</th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Simultaneous</td>
<td>Attention</td>
<td>Successive</td>
<td>Full Scale</td>
</tr>
<tr>
<td>WISC-III</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verbal Comprehension</td>
<td>.27</td>
<td>.69</td>
<td>.17</td>
<td>.61</td>
</tr>
<tr>
<td>Perceptual Organization</td>
<td>.45</td>
<td>.59</td>
<td>.27</td>
<td>.60</td>
</tr>
<tr>
<td>Freedom from Distractibility</td>
<td>.30</td>
<td>.54</td>
<td>.29</td>
<td>.61</td>
</tr>
<tr>
<td>Processing Speed</td>
<td>.70</td>
<td>.35</td>
<td>.54</td>
<td>.32</td>
</tr>
<tr>
<td>Verbal IQ</td>
<td>.33</td>
<td>.67</td>
<td>.25</td>
<td>.59</td>
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<tr>
<td>Performance IQ</td>
<td>.53</td>
<td>.55</td>
<td>.35</td>
<td>.58</td>
</tr>
<tr>
<td>Full Scale IQ</td>
<td>.48</td>
<td>.64</td>
<td>.33</td>
<td>.64</td>
</tr>
</tbody>
</table>

The results of this study suggest that there is moderate evidence to support the concurrent validity of the CAS Full Scale score with the Full Scale IQ score of the WISC-III. The correlation between each assessment measure of general intelligence was .69, suggesting that there are similar abilities being measured by each of these broad batteries. However, the correlation is only in the moderate range, suggesting that these assessments contain a considerable amount of variance in what they are measuring. The study showed similar results for both the mentally and learning disabled groups as well.

Correlations between factor scores of the CAS with the cluster scores of the WISC-III provide support for the convergent and discriminant validity of the PASS model. The Planning factor on the CAS correlates highly with the Processing Speed cluster from the WISC-III (.70). There are significant but modest correlations reported
between Planning and both the Performance Scale IQ score and the Perceptual Organization clusters from the WISC-III (.53 and .45). This information suggests that the Planning factor on the CAS relies considerably on an individual’s ability to process information quickly.

Similarly, the Attention factor on the CAS was shown to significantly correlate with both the Processing Speed cluster (.54) and the Performance Scale IQ (.35) on the WISC-III. However, the degree of significance was found to be modest for the WISC-III Processing Speed factor and low for the Performance Scale IQ. Naglieri (1997) suggests that these correlations are indications that the Attention factor on the GAS is a unique measure of cognitive abilities not previously assessed on other instruments. However, the findings of numerous other research studies (Kranzler & Weng, 1995; Kranzler & Keith, 1999; Keith & Kranzler, 1999) suggest that the Planning and Attention factors are measures of the ability to process information quickly, rather than pure measures of planning and attention.

The CAS and PASS factors most related to the clusters found on the WISC-III, are the Successive and Simultaneous Processing factors. Research cited in the GAS technical manual (Naglieri, 1997) found significant correlations between the Simultaneous Processing factor and each of the WISC-III clusters. Most strongly related were the Verbal Comprehension cluster and Verbal Scale IQ score (.69 and .67). This suggests that tasks associated with the Simultaneous factor are substantial measures of an individual’s ability to reason verbally. Other correlations include Perceptual Organization (.59), Freedom from Distractibility (.54), Performance Scale IQ score (.55), and Processing
Speed, which had a low but significant correlation (.35). This information is an indication that the Simultaneous Processing factor on the CAS measures cognitive abilities similar to those used on more traditional measures of intelligence.

In accordance, the Successive Processing factor on the CAS was found to load consistently across each of the WISC-III clusters, with the exception being that of Processing Speed (.35). This factor loaded highest on both the Verbal Comprehension (.61) and Freedom from Distractibility factors (.61), followed closely by Perceptual Organization (.60) and both the Verbal (.59) and Performance Scale IQ scores (.58). These results suggest that there are considerable abilities shared between the measures of the Successive Processing factor on the CAS and the WISC-III clusters. Based on this study, both Simultaneous and Successive Processing on the CAS assess similar abilities as found on traditional intelligence tests, while the Attention and Planning factors appear to be measures of unique abilities.

**Relationship between the DAS and CAS**

Currently, there are no published studies which have compared these relatively new measures of intelligence. Considering the different theoretical models on which each of these assessments are based, data regarding the relationship between each assessments various broad measures would provide information as to the validity of their usefulness as assessments of specific abilities associated with intelligence.

**Critical Analysis**

Current validation studies support both the construct and concurrent validity of the DAS. Factor analytic data shows the abilities measured by the DAS to be consistent with
Concurrent Validity of the DAS and CAS

the instrument's theoretical structure. The literature (Elliott, 1990; Dumont, et al., 1996) on the concurrent validity of the DAS finds that the instrument provides a good measure of psychometric “g”, and that the DAS cluster scores have adequate convergent and divergent validity. In contrast, literature (Kranzler & Weng, 1995; Kranzler & Keith, 1999; Keith & Kranzler, 1999) focusing on the CAS suggests that the PASS model does not measure the abilities it purports to measure, but rather fits best into a theoretical structure similar to that of the DAS. Although studies vary, the literature points to data which suggests that the CAS is a better measure of general intelligence than of distinct cognitive abilities. However, there is a considerable amount of controversy regarding the structure of the CAS. Its authors dispute claims of the CAS following a hierarchical structure and maintain that the CAS is a measure of the correlated PASS model.

This study will investigate the concurrent validity between the broad scores, cluster scores, and subtest scores of the DAS and CAS. At this time, there are currently no published studies which have attempted to address the relationship between these instruments. As recently developed assessments, it is crucial to establish their credibility through the use of validation studies. Studies of concurrent validity add not only to the overall psychometric qualifications of the instrument, but also towards support of the constructs on which the assessment is based. This is especially important for the CAS, which has not undergone extensive scrutiny regarding the instrument's concurrent validity. In the case of the DAS, several studies have shown support for it's factors, therefore making it an adequate model to compare the CAS against.

Another reason for conducting this study is to update the information presented on
the DAS’s validity. Since many of the studies were performed on instruments that have relatively outdated norms, it is important to offer new information with scales currently in use. There is also the issue that many of the previous studies with the DAS were done with non-theory based instruments. As theories of intellectual and cognitive development gain scientific favor, comparing theory based assessment tools will offer information as to which abilities are being assessed and whether those abilities represent those of the theory on which they were based.

In addition, there are few studies that have investigated using a non-special education population of children. Several of the cited studies looked at special populations, such as cognitively or learning disabled children, which decreases the applicability of that data to average populations. In order to adequately validate an assessment of intelligence, there must be sufficient and reliable normative data on various populations. Using a group of non-special education students provides the necessary basis for which discrepancy determinations are derived.

It is the aim of this investigation to provide unbiased statistical analysis of the psychometric qualities of these instruments which can assist professionals in their decision to use a particular instrument. As evidence of validity is a key element in determining the usefulness of any standardized instrument, it is also the intention of this study is to provide necessary information as to the interpretative qualities of these instruments for making differential diagnoses regarding cognitive and academic functioning. Finally, investigating the concurrent validity of the instruments will provide information to either support or contradict the previous findings regarding the fit of the theoretical models on which the
Because both the CAS and DAS are based on differing theoretical constructs, certain assumptions could be made regarding the relationship between broad factors. However, based on information from previous research regarding the construct and concurrent validity of each instrument, the following correlations are expected:

* Based on the literature regarding the construct validity of these instruments, it is expected that moderate to high correlations will be found between the GCA of the DAS and the Full Scale score of the CAS. In essence, both instruments are expected to be adequate measures of general intelligence.

* It is also expected that factors claiming to assess similar abilities between the CAS and DAS will correlate highly. Specifically, it is expected that the Verbal Ability cluster will correlate the most with the CAS Simultaneous factor. Because of its proposed ability to assess unique cognitive constructs, the CAS Planning factor would likely show the highest correlation with DAS tasks of fluid reasoning and the diagnostic Processing Speed subtest. Accordingly, the CAS Successive processing factor should correlate moderately across both verbal and spatial tasks. Finally, the CAS Attention factor is expected to show low correlations with most tasks on the DAS core battery, as it is considered a unique measure of cognitive abilities not found on most instruments.
Similar to the expected outcomes of the broad factor correlations, it is expected that the CAS and DAS subtests will supply sufficient evidence for convergent and divergent validity. This means that subtests measuring similar abilities will correlate higher than those with dissimilar constructs.

In conclusion, within this chapter can be found the key concepts regarding the role of validity in intellectual assessments. In addition, the chapter detailed the theoretical constructs of both the Differential Ability Scales and the Cognitive Assessment System. Also provided were the significant statistical data pertaining to the validity of each assessment, along with the areas in which further research is needed.
CHAPTER III

Methodology

The purpose of this chapter is to provide a detailed description as to the procedures involved in obtaining information about the concurrent validity between the Differential Ability Scales and the Cognitive Assessment System. Covered within the chapter will be a description of the population to be studied and specific aspects regarding the assessment tools to be used.

Participants

For the purpose of this study, a minimum of 30 volunteers from school districts in western Wisconsin and the metropolitan Twin Cities area in Minnesota will be solicited. The school board from each district will be contacted for permission to recruit and test children within the school district. Once permission has been granted, a brief description of the study and a letter of consent will be given to families of children eligible for participation. Students chosen for this study must be of school age between the ages of 12-15 years-old. Only students with no prior history of having received special education services will be used for this study. Participation in the study will be on a voluntary basis only. Subjects will receive no compensation for participating. Assessment data may not be considered for use in making educationally based decisions regarding the individual. To reduce possible misuse of this information, specific test results will not be shared with parents or students.
Concurrent Validity of the DAS and CAS

Instrumentation

Differential Ability Scales (DAS)

The Differential Ability Scales (DAS) is an individually administered measure of cognitive ability, achievement, and information processing (Elliott, 1990). It is designed to assess the cognitive abilities of children ranging in ages from 2 years 6 months through 17 years 11 months. The school-age battery is divided into two sections: the core battery, which consists of six-subtests, and three diagnostic subtests. Descriptive statistics derived from the DAS include: standard scores with a mean of 100 and standard deviation of 15, percentile ranks, and T-scores for cluster and subtest scores. The DAS was normed using 3,475 non-institutionalized school age children in the United States. The sample adhered to demographic characteristics associated with United States Census data from 1986 (Elliott, 1990).

The DAS school age battery yields a composite score, known as the General Conceptual Ability (GCA) score which is derived from the six core subtests. The GCA is considered the most global measure of cognitive functioning on the DAS. Additionally, the DAS offers three interpretable cluster scores, Verbal Ability, Non-verbal Reasoning Ability, and Spatial Ability. The composite and cluster scores are interpreted through the use of standard scores, percentile ranks, and T-scores. Each composite score is determined using the raw scores from two subtests which represent that cognitive area. Of the core subtests, Recall of Designs and Pattern Construction make up the Spatial Ability Composite, Word Definitions and Similarities make up the Verbal Ability Composite, and the Non-verbal Reasoning Composite is made up of Matrices and Sequential and
Quantitative Reasoning. Diagnostic subtests are considered supplementary and therefore, do not contribute to the GCA. The following is a synopsis of each subtest as they pertain to their specified composite, including a brief description of the task involved and the types of abilities they are measuring.

**Spatial Ability Cluster**

*Recall of Designs.* Requires the child to focus on an unfamiliar design for a total of five seconds. The design is then removed and they are asked to reproduce that design on a blank sheet of paper. The task involves utilizing short-term memory of visual and spatial relationships, as well as visual-motor control (Elliott, 1990).

*Pattern Construction.* Assesses a child’s ability to solve problems using non-verbal reasoning and spatial visualization skills (Elliott, 1990). This subtest resembles the Block Design subtests found on each of the Weschler tests (WPPSI-R, WISC-III, and WAIS-III). This task involves having the child replicate two-dimensional patterns using three-dimensional plastic blocks, within a specified time limit.

**Verbal Ability Cluster**

*Word Definitions.* This subtest is very similar to that of vocabulary subtests found on other intelligence batteries (Elliott, 1990). The task requires the examiner to orally present a list of words of increasing difficulty, to which the child gives the word’s meaning. Skills measured on this subtest include the ability to express oneself verbally and recall factual information from long-term memory. The child must be able to form verbal concepts using their knowledge of basic language to respond correctly. Elliott (1990) states that a level of abstract thinking and verbal fluency are required in this task since
correct responses require giving “the meaning of the word rather than merely to use it correctly in context” (p. 56). The task asks the child to process familiar knowledge in a new way.

**Similarities.** This task involves verbally stating the relationship between common items. The Similarities subtest assesses a child’s overall ability to inductively reason verbally, utilizing a general knowledge base (Elliott, 1990). The child needs to combine both logical and abstract thinking to develop hypotheses about verbally presented information, and use that information to delineate between essential and superficial aspects of each item. Similarities on the DAS however, differs in two distinct ways from its predecessors. The first difference relates to how the item is scored. Rather than awarding points based on various levels of correct response, Similarities on the DAS does away with hierarchical response levels. In order to receive credit on an item, a response must fit into a specific range of responses, reducing the effect of receiving partial credit. Second, the DAS requires making connections between three items, rather than two found on other tests (Elliott, 1990). This is aimed at reducing the level of ambiguity between possible responses and helps to delineate an acceptable range of correct versus incorrect scores, thus reducing the need for subordinate scoring levels.

**Non-Verbal Reasoning Cluster**

**Matrices.** The Matrices subtest on the DAS is much like those found on most assessments of cognitive abilities, and is arguably one of the best measures of non-verbal reasoning (Elliott, 1990). On the DAS, a set of either four or nine boxes or cells is visually presented to the child. Each cell has a shape or design. The child is to choose from one of
six options, the shape or design which follows and completes a designated pattern (Elliott, 1990). Much in the same way as the Similarities subtest requires the child to develop hypotheses regarding relationships using abstract verbal reasoning, Matrices can be considered the non-verbal correlate of Similarities (Elliott, 1990). This task measures the ability to perceive novel visual and spatial information, develop and apply a logical understanding of the relationships between that information, and differentiate between competing or similar information. Thus the child must learn to problem solve using unfamiliar information in a way that makes sense.

*Sequential and Quantitative Reasoning.* This subtest requires making determinations regarding sequential patterns presented in either figure or numeric form (Elliott, 1990). The subtest is divided into two distinct portions, the first involves forming abstract shape patterns, whereas the second consists of using a series of numbers. Items are presented visually, with minimal verbal directives. Figure items are presented in a sequential display, in which the response must correctly complete the order. Numeric items require making quantitative determinations regarding the relationships between the numbers using simple mathematical rules (addition, subtraction, multiplication, or division). The child must determine the rule used independently. The task assesses the ability to reason nonverbally (Elliott, 1990). Specific skills involved include, inductive reasoning using past knowledge, being able to perceive sequential patterns and formulate hypotheses about relationships, and analytically breaking down problems into specific components. This subtest requires a child to display flexibility in thought and problem solving. Children lacking basic number knowledge and arithmetic skills may have difficulty
Concurrent Validity of the DAS and CAS

Diagnostic Subtests

The diagnostic subtests include Recall of Digits, Recall of Objects (Immediate), and Speed of Information Processing. Diagnostic subtest scores can be combined with several core scores to yield what is known as a Special Non-verbal Composite used for supplementary analysis. The following is a brief description of each Diagnostic subtest.

Recall of Digits. Similar to number recall used on many intelligence assessments, this task requires the child to correctly repeat a string of spoken numbers. This subtest is a direct assessment of short-term auditory memory skills (Gsm) and has indirect correlation with general cognitive abilities. Recall of Digits differs on the DAS from similar subtests on other assessments in that numbers are read at a pace of two per second, which is considered a more natural form of memory ability (Elliot, 1990).

Recall of Objects (Immediate/Delayed). The immediate portion of this task involves recalling the names of common objects over a period of three trials. For the first trial, the pictures are exposed for one minute, but only for 20 seconds on following trials. For the delayed portion, given between 20-30 minutes following the immediate trials, no pictures are shown. Scores for the Immediate portion are derived from a combination of the three trials. Scores for the Delayed portion are based only on the single administration which follows the Immediate trials. This test measures both short and long-term visual memory.

Speed of Information Processing. This task requires the child to determine the greatest number from a row of numbers and mark it with a pencil. Each item consists of a
page with several rows of numbers for which the child’s rate of solving is timed. The test assesses both speed and accuracy, and is considered a measure of processing speed (Gs). Other abilities assessed with this task include quantitative recognition, sequential and perceptual processing, and short-term numerical memory. The subtest is considered to have a slight correlation with overall cognitive ability.

Cognitive Assessment System (CAS)

The Cognitive Assessment System (CAS) is an individually administered measure of cognitive abilities (Naglieri, 1999). It is designed to assess cognitive processing of children between the ages of 5 years and 17 years 11 months. The CAS features a 12-subtest Standard Battery which provides as its most global measure, a Full Scale standard score with a mean of 100 and standard deviation of 15. Along with the Full Scale score, the CAS provides standard composite scores for the Planning, Attention, Simultaneous, and Successive Scales respectively. Each of these composites is made up of three subtests from the Standard Battery. All composite scores can be interpreted in terms of standard scores and percentile ranks.

The subtests that make up the four composite scores and the Standard Battery include the following: Matching Numbers, Planned Codes, and Planned Connections form the Planning Composite; Expressive Attention, Number Detection, and Receptive Attention contribute to the Attention Composite; Nonverbal Matrices, Verbal Spatial Relations, and Figure Memory combine to make the Simultaneous Composite; and Word Series, Sentence Repetition, and Sentence Questions form the Successive Composite.
Planning Subtests

Tasks considered to assess planning ability require an individual to develop an approach or strategy for to solve a problem (Das, Naglieri, & Kirby, 1994). Successful completion of planning tasks are a result of efficient strategies which enable the individual to solve the item quickly. Unlike other methods of assessment, planning items do not increase in difficulty, but rather alter the strategy needed to solve. This may include changing the stimulus object, or requiring the child to solve the problem using a different strategy.

Planned Connections. This task involves having the child “connect a series of boxes containing numbers or letters in correct sequence” (Das & Naglieri, 1997, p. 24), within a specified time limit. The first six items use only number sequences, with the last two items involving sequencing of alternating numbers and letters. This task assesses the ability to formulate effective strategies in which to solve problems quickly (Das, Naglieri, & Kirby, 1994). Problem solving strategies such as visual scanning and identifying stimuli accurately are considered to be highly involved in planning.

Matching Numbers. The task requires the child to locate from a row of numbers, those which are the same and underline them within a specified time limit. Each item contains eight rows of numbers with each row containing six numbers. Number pairs can range from between one to six digits. Successful completion on this task involves developing an effective strategy for identifying the correct numbers. The ability to process information quickly and visual-motor ability play a role in solving these tasks.

Planned Codes. This subtest “requires the individual to develop an efficient
strategy to finding a particular stimulus on a page” (Das, Naglieri, & Kirby, 1994, p. 104). Similar to the Digit Symbol subtest used on the WAIS-III (Weschler, 1983) the task entails having the child partner individual letters (A, B, C, D) into various letter codes (XO, OO, OX, XX). However, this task differs in that the stimuli used for the CAS is familiar to the child (letters into letters). This is designed to be a more true measure of planning as it relates to academic tasks. Each item is contained on a separate page, which consists of the pairing of letter codes at the top, followed below by rows of letters with empty boxes beneath. Within a specified time limit, the child must correctly fill in as many boxes as possible according to the code pattern. Each item follows a different solution pattern.

Successive Processing Subtests

Successive processing tasks test the ability to comprehend and interpret ordered events in a meaningful way. They require the subject to process sequential information for which the meaning of the task is derived from the order (Das & Naglieri, 1997).

Word Series. Resembling the subtests from other assessments in which the subject is read a series of numbers and must repeat them in correct order, Word Series on the CAS utilizes words in place of numbers. Items range in difficulty from two to nine words, and credit is only given for exact responses. Common, highly used words were chosen but presented in a manner so that no logical connection between word pairs could be formed (Das & Naglieri, 1997). Various research has shown the repetition of words and digits to be highly related to successive processing (Das & Naglieri, 1997).

Sentence Repetition. Similar to a subtest on the WPPSI-R (Weschler, 1990), the
CAS Sentence Repetition subtest requires the subject to repeat verbatim sentences presented orally. However, different from previous subtests of this type, the CAS uses non-meaningful color words (i.e., “the red is greening”). This method is employed to reduce the effects of simultaneous processing being used to solve an item (Das & Naglieri, 1997). Correct responses on this task require an understanding of both the order from which words are presented and the syntax of the sentence.

*Sentence Questions.* This subtest is generally considered a comprehension task in which the subject answers questions about sentences similar to those used in Sentence Repetition (Das & Naglieri, 1997). Understanding syntactic organization is essential to successful completion of this task, and is considered to be strongly related to successive processing (Luria, 1982).

**Simultaneous Processing Subtests**

Tasks of simultaneous processing require the subject “interrelate the component parts of the particular item” (Das, Naglieri, & Kirby, 1994, p. 109). Successful completion of simultaneous tasks involves the ability to understand relationships among all objects or items and incorporate that information into an overall pattern or idea.

*Nonverbal Matrices.* This subtest requires the subject choose from six possible choices, that which best completes the pattern or relationship between a visually presented group of items. Matrices measures the ability to reason by analogy, organize and synthesize complex visual-spatial relationships, and draw logical conclusions through integration of parts into a whole.

*Verbal-Spatial Relations.* The subject must decide from six choices, the response
which best answers an item presented orally, within a specified time limit. Similar to the Matrices task, this subtest however involves making logical comparisons using grammatical information about pictures (Das & Naglieri, 1997). The child must match a pictured object with the verbal description given.

Figure Memory. This final simultaneous task involves having the child view a two or three dimensional object for five-seconds, remove the object, and ask them to select the object which has been embedded in a larger, more complex design. Correct responses entail having all lines of the original design indicated without additions or omissions. Similar to both design copying and drawing from memory subtests on numerous assessments, this task has consistently been recognized as loading on the simultaneous factor (Das, Naglieri, & Kirby, 1994).

Attention Subtests

Tasks of attention typically involve the ability to focus on one, relevant stimuli, while ignoring aspects of similar, competing information. Successful completion of these tasks requires the control of cognitive activity towards the recognition of a specific stimuli and deciding to respond to that stimuli while inhibiting other responses within a complex environment (Das & Naglieri, 1997).

Expressive Attention. This task requires the subject begin by reading a list of color words (i.e., green, red, blue, etc.) as quickly as possible. This is followed by having them name colors presented on a series of shapes. They are then asked to view the color words which are printed in opposing colors. Subjects must attend to the color of the word while ignoring the color stated by the word itself. This is an adaptation of the Stroop Test.
Concurrent Validity of the DAS and CAS (Stroop, 1935, Goldin, 1978), and has long been considered an effective means of discerning attention (Naglieri & Das, 1988).

Receptive Attention. This task involves having the subject identify letter pairs depending upon one of two possible rules. The first has them underline letters which are physically alike (i.e., T, T or t, t). The second item has the subject identify letter pairs having the same name (i.e., T, t or A, a). Several studies (Naglieri & Das, 1988, Naglieri, Braden, & Gottling, 1993) indicate a strong element of attention involved in this task.

Number Detection. This task is “designed to measure selectivity, ability to shift attention, and resistance to distraction” (Das & Naglieri, 1997, p. 19). The subject is required to underline numbers that correlate with previously presented stimuli. Each item contains both the target numbers and distracters, which the subject must discern between. To reduce making this a processing task, the subject must complete the page from left to right and from top to bottom. Each item must be completed with a specified time limit.

Procedures

Each participant will be individually administered the DAS and the CAS. To reduce the possibility of practice effects, there will be at least one week between administration periods. Administration will take place at a designated site that will allow for proper testing. Tests will be administered in a counter-balanced sequence as to reduce order effects. Participants will be administered Standard Battery and Diagnostic subtests from both instruments. This will provide the fullest measure of cognitive abilities. Testing time for each assessment is expected to take between 1-2 hours. Test examiners will consist of advanced graduate students enrolled in an accredited school psychology
program, with training in test administration.

Data Analysis

Complete protocol scoring, including behavioral assessments taken through observation during testing, will be done for each administration. Protocols will be scored by graduate level school psychology students trained in the administration and scoring of these assessments. Analysis of the data will be done in order to compare differences between the DAS and CAS. Means, standard deviations, and range of scores will be calculated. An analysis of variance (ANOVA) will be conducted in order to determine the effect of administration order and it’s impact on test results. Correlation coefficients will be calculated to determine the strength of the relationship between the DAS and the CAS, and to identify relative weaknesses between variables that are expected to measure different abilities within each battery.

The data analysis described above will be conducted to address the specific research questions presented in Chapter I. Each question is provided below.

R1: This question will examine the strength of the relationship or the amount of correlation between the Cognitive Assessment System’s Full Scale and four cluster scores, with the Differential Ability Scales General Concept Ability and three ability cluster scores. It is expected that modest positive correlations will exist between global and cluster scores assessing similar abilities.

R2: This question will examine the strength of the relationship or the amount of correlation between specific subtest scores from the Cognitive Assessment System
Concurrent Validity of the DAS and CAS and Differential Ability Scales. It is expected that subtests will correlate more significantly with those stated as assessing the same or similar abilities.

**Conclusion**

The proposed study will provide information regarding the concurrent validity of the DAS and CAS which will contribute to the existing literature in several ways. The first of which will expand on the available research by either supporting or refuting current claims of concurrent validity. Secondly, the information from this study can be used in collaboration with previous studies of construct validity to assist in supporting or refuting the theoretical claims on which these instruments are based. Finally, using two of the most recently developed assessment tools, this study will provide relevant data regarding the usefulness of each instrument in making disability determinations.
REFERENCES


Concurrent Validity of the DAS and CAS. Journal of Psychoeducational Assessment, 8, 344-355.


Dear Parent:

I am a graduate student in the School Psychology training program at the University of Wisconsin-Stout. Currently, I am obtaining data for my specialist’s thesis. The purpose of the study is to examine the differences in cognitive abilities in children. This is important for professionals who work with children in providing appropriate educational services according to a child’s academic abilities.

I would like to ask for your permission for your child to participate in this study. This involves administering three intelligence assessments to your child. These are the Differential Ability Scales, the Cognitive Assessment System, and the Woodcock Johnson-Third Edition Test of Cognitive Ability. Administration of these assessments will take approximately two and one-half hours.

Children who participate in this study will be kept completely anonymous. Only the scores received by each child will be recorded along with any pertinent demographic data to ensure confidentiality.

If you would like more information about this study, please complete this form and return it to your child’s teacher. You will be contacted shortly thereafter with further information about the nature of the study and your child’s participation. If you have any additional questions, please contact the University of Wisconsin-Stout at 715-232-2211.

Thank you,

Greg Kolar and Karen Hendershott
University of Wisconsin-Stout

_____ Please contact me regarding this study

Child’s name ________________

The best time to reach me is:

____ morning
____ afternoon
____ evening
____ other (fill in)

Phone Number: ____________