WOODCOCK-JOHNSON TESTS OF COGNITIVE ABILITIES - THIRD EDITION AND UNIVERSAL NONVERBAL INTELLIGENCE TEST IQ SCORES: DOES AUTISM DIAGNOSIS MAKE A DIFFERENCE?

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ABSTRACT

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The primary purpose of this study was to investigate intellectual assessment of individuals with an Autism Spectrum Disorder (ASD). Specifically, the study attempted to determine if there were significant differences among two intellectual assessments, the Woodcock-Johnson Tests of Cognitive Abilities – Third Edition (WJ III COG) and the Universal Nonverbal Intelligence Test (UNIT), between three ASD including high-functioning autism (HFA), Asperger Syndrome (AS), and Pervasive Developmental Disorder Not Otherwise Specified (PDD-NOS). Sixty-five participants were recruited through notices placed in local newspapers to find children ages 8 to 18 years of age with an ASD diagnosis from a physician, licensed psychologist, or pediatric neurologist. Results showed that there were no significant differences between HFA and AS on any of the intellectual measures including WJ III COG GIA, UNIT Full Scale, as well as other scores from these tests. However, children with AS had significantly higher scores than PDD-NOS children on the UNIT Reasoning Quotient and the WJ III COG Verbal Comprehension subtest. Implications of the results of this study were discussed.

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CHAPTER I

INTRODUCTION

Leo Kanner's original paper which introduced the label "early infantile autism" was published in 1943. Just one year later in 1944, Hans Asperger published his thesis on the topic of "autistic psychopathy" or autism as we would refer to today. Kanner described children who had severe autistic behaviors. While Asperger studied the whole spectrum of autism from mental retardation to children who were much higher functioning, he became interested in the "more able" children who manifested milder symptoms of autism (Attwood, 1998; Frith, 1991). Kanner's paper became extremely popular while Asperger's paper was largely ignored in Europe and the United States (Attwood, 1998; Frith, 1991). It was not until the 1980's that Asperger's work became popular. Lorna Wing (1981) was the first person to use the term Asperger's syndrome (AS) and sparked an interest in Asperger's previous writings (Attwood, 1998; Wing, 2000). Wing recognized the importance of Asperger's work long before anyone else did and instigated the translation of Asperger's 1944 paper from German to English (Frith, 1991).

Autism, Asperger Syndrome (AS), and Pervasive Developmental Disorder, not otherwise specified (PDD-NOS) are currently separate diagnostic categories in the *Diagnostic and Statistical Manual for Mental Disorders-4th Edition-Text Revision (DSM-*

IV-TR, American Psychiatric Association, 2000) and the International Classification of Diseases-Tenth Revision *(ICD-10*, World Health Organization [WHO], 1992). Autism and AS share many clinical features including: impairments in reciprocal social interaction, repetitive stereotypic activities, and impairment of verbal and nonverbal communication (Szatmari, 1998; WHO, 1992). However, AS differs from autism primarily because there is no general delay in language or cognitive development (WHO, 1992).

When children are diagnosed with an Autism Spectrum Disorder (ASD), an intelligence test is typically administered as part of the full evaluation. Intelligence testing with children with an ASD has been the topic of much scientific research. The term "high-functioning autism" (HFA) generally refers to individuals with an IQ level that is considered to be above the mentally retarded range (IQ > 70), while "low-functioning autism" generally refers to individuals with an IQ level considered to be at or below the mentally retarded range (IQ < 70) (Chan, Cheung, Leung, Cheung, & Cheung, 2005; Howlin, 2003).

There has been a generous amount of research that has focused upon how children with an ASD perform on the Wechsler Intelligence Scale for Children–Third Edition (WISC-III; Wechsler, 1991). For a summary of Wechsler intellectual (IQ) profiles of children with ASD, see Barnhill, Hagiwara, Myles, and Simpson (2000). In general, children with high- and low-functioning ASD score higher on Block Design (Performance IQ subtest) and lower on Comprehension (Verbal IQ subtest) (Barnhill et al). Barnhill et al. reported there has not been a specific cognitive profile pattern established for individuals diagnosed with Asperger Syndrome.

Much of the previous research related to intellectual functioning has focused on how children with HFA vs. AS perform on Verbal and Nonverbal IQ measures from the Wechsler scales. However, there is very little, if any, research regarding how children with an ASD perform on the Woodcock-Johnson Tests of Cognitive Abilities–Third Edition (WJ III COG; Woodcock, McGrew, & Mather, 2001) or the Universal Nonverbal Intelligence Test (UNIT; Bracken & McCallum, 1998). It is important to understand how children with different ASD diagnoses perform on cognitive assessments with a verbal component (WJ III COG) and nonverbal intellectual assessments (UNIT).

The manual for the UNIT states "the UNIT also provides diagnostic information relevant to educational exceptionalities (e.g., mental retardation and learning disabilities) and psychiatric disorders (e.g., selective mutism and autism)" (Bracken & McCallum, 1998, p. 1). The UNIT provides diagnostic information for children with autism yet no children with an ASD were included in the standardization sample. The Individuals with Disabilities Education Improvement Act of 2004 Federal Regulations §300.532(c)(1) state "any standardized tests that are given to a child – (i) Have been validated for the specific purpose for which they are used" (Texas Education Agency Office of Special Education, 2004). Examiners need to have a better understanding of how children and adolescents with an ASD perform on intellectual or cognitive assessment instruments since individuals with an ASD were not included in the standardization sample for both the UNIT and the WJ III COG.

For children with disabilities, assessment often leads to recommendations for treatment and education. If examiners are making recommendations for treatment and education based upon scores from an intelligence or cognitive assessment instrument, it is important to understand which instrument is the most appropriate test of intelligence to give to a child based upon their diagnosis. Since intellectual functioning is a part of every child's full and individual evaluation for special education services (Texas Education Agency Office of Special Education, 2004), it is important to understand how children with different ASD diagnoses perform on intellectual or cognitive assessment instruments.

The purpose of this study is to add to the existing body of research regarding intellectual assessment of individuals with HFA and AS. There has been little or no research regarding intellectual assessment of individuals with an ASD as measured by the WJ III COG and the UNIT. Specifically, this study will attempt to determine if there are significant differences between overall IQ scores for the WJ III COG (GIA) and the UNIT (Full Scale IQ) for three different diagnostic categories of HFA, AS, and PDD-NOS. While it is important to understand how individuals with ASD score on the overall scores of intellectual tests, Attwood (1998) cautions against the use of a single IQ score to explain the intellectual abilities of a child or adolescent. "The pattern is more important than the number" (Attwood, p. 116). Therefore, in addition to the overall IQ scores on the WJ III COG and UNIT, comparisons of additional scores will be made. Comparison of WJ III COG broad abilities or cognitive performance clusters (Verbal Ability, Thinking Ability, and Cognitive Efficiency), and factor cluster scores of seven more narrow abilities including: Comprehension-Knowledge (Gc), Long-Term Retrieval (Glr), Visual-Spatial Thinking (Gv), Auditory Processing (Ga), Fluid Reasoning (Gf), Processing Speed (Gs) and Short-Term Memory (Gsm) and four additional scales from the UNIT, including the Memory Quotient, Reasoning Quotient, Symbolic Quotient and Nonsymbolic Quotient, will be compared between the three diagnostic groups to determine if there are different profiles for each of these groups.

With the lack of research on the UNIT and the WJ III COG with individuals with an ASD, several research questions can be generated. Since individuals with AS perform better on Verbal IQ tasks than individuals with HFA (Barnhill et al., 2000), it was hypothesized that individuals with AS would score higher on the WJ III COG GIA than individuals with HFA. Since HFA individuals appear to perform better on nonverbal tasks than AS individuals (Barnhill et al., 2000), it was hypothesized that HFA individuals would perform better on the UNIT Full Scale score than AS individuals. In addition to the overall WJ III COG GIA score and the UNIT Full Scale IQ score, comparisons were made with other scores from both intelligence measures. In continuing with the notion that AS individuals perform better on verbal tasks than HFA individuals, it was hypothesized that AS individuals would outscore HFA individuals on the Verbal Ability cluster of the WJ III COG. In addition, it was also hypothesized that HFA individuals would score higher than the AS individuals on all the four additional scales from the UNIT including the Memory Quotient, Reasoning Quotient, Symbolic Quotient and Nonsymbolic Quotient since the scales are a measure of nonverbal intelligence.

CHAPTER II

REVIEW OF THE LITERATURE

This chapter discusses the diagnostic criteria and prevalence rates for autism, Asperger Syndrome (AS), and Pervasive Developmental Disorder, not otherwise specified (PDD-NOS) based upon the *Diagnostic and Statistical Manual for Mental Disorders 4th Edition-Text Revision (DSM-IV-TR;* American Psychiatric Association [APA], 2000). This chapter discusses the debate of whether high-functioning autism (HFA) and AS are the same disorder or should be distinct diagnostic categories. Next, this chapter concentrates on an explanation of intellectual assessment including verbal and nonverbal intelligence. Subsequently, this chapter focuses on the lack of research using the Universal Nonverbal Intelligence Test (UNIT; Bracken & McCallum, 1998) and Woodcock-Johnson III Tests of Cognitive Abilities (WJ III COG; Woodcock et al., 2001) with individuals with Autism Spectrum Disorders (ASD). Finally, why this study is important to the field of school psychology is addressed.

Diagnostic Criteria

Autism is a developmental disorder in which impairments in socialization and communication can vary from mild to severe. The *DSM-IV-TR* (2000) provides the most current diagnostic criteria for ASD including autism, AS, and PDD-NOS. For the full list of eligibility criteria for the diagnosis of autism see Appendix A; for Asperger Syndrome, see Appendix B; and for PDD-NOS, see Appendix C. The diagnostic criteria for Autistic Disorder includes qualitative impairment in social interaction and communication, and restricted repetitive and stereotyped patterns of behavior, interests and activities. The diagnostic criteria for Asperger's Disorder is similar to Autistic Disorder as it includes qualitative impairment in social interaction and restricted repetitive and stereotyped patterns of behavior, interests and activities; however, there is no clinically significant general delay in language or cognitive development in Asperger's Disorder. The diagnostic criteria for PDD-NOS is used when there is a severe and pervasive impairment in the development of reciprocal social interaction associated with impairment in either verbal or nonverbal communication skills or with the presence of stereotyped behavior, interest, and activities, but the criteria are not met for Autistic Disorder because of late age at onset, atypical symptomatology, or subthreshold symptomatology, or all of these.

There is a significant lack of consensus about what are the most appropriate diagnostic criteria for AS. Hans Asperger (in Attwood, 1998) and Lorna Wing (1981) never discussed specific diagnostic criteria for the AS children they described. Some research has used the *DSM-IV-TR* (2000) criteria; some have used the *International Statistical Classification of Diseases and Related Health Problems-10th Edition (ICD-10)* criteria (World Health Organization [WHO], 1992), while other clinicians have proposed their own set of diagnostic criteria for the diagnosis of AS (Gillberg & Gillberg, 1989; Szatmari, Bremner, & Nagy, 1989). Szatmari et al. (1989) proposed AS should be considered a separate diagnosis from PDD-NOS. It should be noted that this statement was made prior to the inclusion of diagnostic criteria for AS in the *Diagnostic and Statistical Manual for Mental Disorders 4th Edition (DSM-IV;* APA, 1994).

Klin, Pauls, Schultz, and Volkmar (2005) examined three alternative definitions for AS (i.e., DSM-IV, presence/absence of communicative phrase speech by age 3, and a new system that highlighted prototypical features of AS). The results of their study found poor agreement between the three diagnostic systems. Fifty-six percent of the participants received at least two different diagnoses (i.e., autism, AS or PDD-NOS) depending on which definition was used.

Prevalence of Autism, AS, and PDD-NOS

Depending on what source you read, there are significant differences in the prevalence of ASD. *DSM-IV-TR* (2000) cites the following prevalence rate for autism, "the median rate of Autistic Disorder in epidemiological studies is 5 cases per 10,000 individuals, with reported rates ranging from 2 to 20 cases per 10,000 individuals," (p. 73). Prevalence rates for AS, as reported by *DSM-IV-TR,* state "definitive data regarding the prevalence of Asperger's Disorder are lacking," (p. 82). No prevalence rates for PDD-NOS are given. Prior (2003) from Australia and Fombonne (2003) from Canada discussed the prevalence rates of ASD and the possible reasons for an apparent increase in the numbers of children diagnosed with an ASD. Both researchers suggest that diagnostic practices and improved public awareness of ASD may explain the increased prevalence rates in ASD. Fombonne reported the rates of all forms of pervasive developmental disorders range from 30 in 10,000 to as high as 60 in 10,000. Fombonne stated the rate of AS is not well established but a conservative estimate is 2.5 in 10,000. These rates were based on studies from countries all over the world, including the United Kingdom, Denmark, USA, Japan, Sweden, Ireland, Germany, Canada, France, Indonesia, Norway, Finland, and Iceland. Gillberg and Gillberg (1989) estimate the prevalence of AS in the population of Swedish school children to be between 10 and 26 per 10,000. A recent study by the U.S. Centers for Disease Control and Prevention (CDC) reported 5.5 out of every 1,000 school-age children have been diagnosed with autism (Associated Press, 2006).

As one can see, there are significant discrepancies with regards to prevalence rates depending on what country or area the researchers are reporting. The prevalence rates of ASD are on the rise with increased speculation as to why this is happening (Prior, 2003). With prevalence rates of ASD increasing, it is important that school psychologists have a better awareness of diagnostic procedures as well as differences in treatment based upon diagnosis. If there are differences in treatment, school psychologists need to understand if there really is a difference between HFA and AS individuals.

High-Functioning Autism vs. Asperger Syndrome

Lorna Wing (2000) remarked "I have felt like Pandora after she opened the box." Wing (1981) initially emphasized the fact that there were no differences between Asperger syndrome and autism. Her intention was to

> emphasize the strong possibility that the syndrome was part of the autistic spectrum and that there were no clear boundaries separating it from other autistic

disorders. However, since then, various workers have tended to the belief that Asperger syndrome and autism are different conditions – quite the opposite of my intention (Wing, 2000, p. 418).

When Wing wrote the article "Asperger's Syndrome: A Clinical Account" in 1981, she started a wave of research about Asperger Syndrome.

Frith asked the question, "should autism and Asperger's syndrome be seen as distinct and mutually exclusive diagnostic categories, or should Asperger's syndrome be seen as a subcategory of autism?" (1991, p.2). At that time, she proposed that individuals with AS belong in the autism spectrum. Frith stated that the contributors to the book, *Asperger and His Syndrome*, "see Asperger syndrome individuals as distinct from other autistic individuals, as better at communicating by virtue of their better language, and as more likely to achieve successful adaptation" (Frith, p. 12).

More recent research and writings have attempted to address the debate whether HFA and AS are different conditions but part of the same spectrum of disorders. Szatmari (1998) stated "it is less clear that the differentiation of AS from other PDDs is as clinically useful because there is no consensus that AS has a specific etiology, outcome, or treatment different from higher-functioning autism" (p. 62). Ozonoff and Griffith (2000) discuss the difficulties of separating the effects of cognitive and language ability when comparing AS to autism. "If HFA and AS diverge on meaningful cognitive and behavioral dimensions, then the treatments prescribed for the disorders might differ substantially" (p. 73). Therefore, it is important to know if these two diagnostic categories score differently on intellectual instruments.

Macintosh and Dissanayake (2004) attempted to look at empirical evidence to determine if HFA and AS were distinct categories or if both of the disorders belonged on an autism spectrum. Macintosh and Dissanayake reviewed research articles from databases, such as PsychINFO and Medline, as well as book chapters, reference lists from relevant articles, and recent editions of key journals up until 2002. The overall findings of the review suggest that it is still unclear if HFA and AS are distinct categories or part of the same spectrum. The authors (Macintosh & Dissanayake) cite numerous research articles, book chapters, etc. that provide conflicting information about HFA and AS in the areas of cognitive and neuropsychological profiles, early language and communication delays, executive functioning, social-cognitive abilities, motor skills and diagnostic criteria for inclusion in study (*DSM-IV*, 1994; *ICD-10*, 1992; Szatmari et al., 1989). It is also suggested that some of the mixed results of the research findings are due methodological problems such as the use of modified DSM/ICD criteria in the diagnosis of AS, which results in the lack of comparability across studies. Additional methodological problems include: poor matching of groups on verbal mental age and chronological age, circularity in the relationship between diagnostic criteria and the differences in language-based abilities, and small sample sizes. Based upon the research evidence, Macintosh and Dissanayake stated "it appears that there are very few qualitative distinctions between high-functioning autism and Asperger's disorder, with most symptoms, associated features, and biological indices being shared or overlapping to some degree" (p. 431). Because there is not a clear consensus that AS is a syndrome distinct from HFA, it is important to know if these two diagnostic categories score differently on intellectual instruments because different ASD diagnostic categories may need specific intervention strategies.

Intellectual Functioning

There is disagreement throughout research studies about how low an individual's IQ score can be and still consider the diagnosis of HFA. HFA generally refers to individuals with an IQ level that is considered to be above the mentally retarded range (IQ > 70), while "low-functioning autism" generally refers to individuals with an IQ level considered to be at or below the mentally retarded range (IQ < 70) (Chan, Cheung, Leung, Cheung, & Cheung, 2005; Howlin, 2003); however, some research studies have used 80 or higher as a cutoff for HFA (Heerey, Capps, Keltner, & Kring, 2005). AS individuals typically score in the average range of intelligence (Frith, 1991).

There is a plethora of research involving individuals with ASD and intellectual assessment which include a discussion between verbal and nonverbal intelligence. Verbal intelligence refers to the ability to respond verbally with learned information (Sattler & Saklofske, 2001). The Verbal Scale on the Wechsler Intelligence Scale for Children–Third Edition (WISC-III; Wechsler, 1991) is considered "an index of verbal ability and verbal comprehension and a reflection of crystallized intelligence" (Sattler & Saklofske, p. 310). Barnhill et al. (2000) found that individuals with AS perform better on Verbal IQ tasks than individuals with HFA. Ozonoff, Rogers, and Pennington (1991) found that ten individuals diagnosed with AS had a significantly higher Verbal IQ than Performance IQ. The same profile was not found in the 13 individuals with HFA. While some studies found significant differences between Verbal IQ and Performance (or nonverbal) IQ with ASD children and adolescents, others have not. Klin et al. (2005) compared IQ profiles for autism, AS and PDD-NOS groups as assigned by three diagnostic systems (i.e., DSM-IV, presence/absence of communicative phrase speech by age 3, and a new system that highlighted prototypical features of AS). Klin et al. found no significant differences between Full Scale IQ, Verbal IQ, and Performance IQ in all three diagnostic systems. However, there were significant differences in the Verbal IQ-Performance IQ differential in the DSM-IV criteria and new system that highlighted prototypical features of AS. In both cases, the AS and autism groups showed significant differences on the Verbal IQ-Performance IQ differential.

Nonverbal intelligence refers to the ability to problem solve and use abstract reasoning skills without any language or verbal component. With regards to the WISC-III, Sattler and Saklofske (2001) report, "You can consider the Performance Scale as an index of nonverbal ability and perceptual organization and a reflection of fluid intelligence" (p. 310). On the WISC-III, the stimuli for the Performance subtests are nonverbal except for the instructions. The child is required to give motor and sometimes a brief verbal response. The UNIT, however, is "administered by the examiner and completed by the examinee without the use of receptive or expressive language, making it a truly nonverbal measure" (Bracken & McCallum, 1998, p. 2). The UNIT is a nonverbal intelligence test developed to be used with special populations including individuals who have difficulty with language dependent aspects of intelligence.

There are many research studies that evaluated individuals with ASD using nonverbal IQ tests including the Test of Nonverbal Intelligence–Second and Third Editions (TONI-2; Brown, Sherbenou, & Johnsen, 1990; TONI-3; Brown, Sherbenou, & Johnsen, 1997). Often the TONI-2 and TONI-3 are used to match groups on nonverbal IQ to make comparisons. For example, Chan et al. (2005) used the TONI-3 to match five- to six-year-olds who were typically developing to children with autism based upon nonverbal IQ scores. When the two groups were matched on nonverbal intelligence scores, there was still a significant difference in the verbal skills between the typical children and the children with autism.

Some research has proposed that individuals with AS often have visual-spatial deficits (Klin, Volkmar, Sparrow, Cicchetti, & Rourke, 1995). Klin et al. suggested that individuals with AS displayed cognitive profiles similar to those of an individual with nonverbal learning disabilities (NLD). NLD are characterized by

> deficits affecting the nonverbal aspects of the child's functioning including deficits in tactile perception, psychomotor coordination, visual-spatial organization, nonverbal problem-solving, and appreciation of incongruities and humor. Individuals with the NLD profile are also reported to exhibit well developed rote verbal capacities and verbal memory skills, difficulty in adapting

> to novel and complex situations and overreliance on rote behaviors in such situations, relative deficits in mechanical arithmetic as compared to proficiencies in single word reading, poor pragmatics and prosody in speech, and significant deficits in social perception, social judgment, and social interaction skills (Klin et al., p. 1129-1130).

Klin et al. found no differences in Full Scale IQ for the AS and HFA groups; however, Verbal IQ and Performance IQ were significantly different. The group diagnosed with AS had significantly higher Verbal IQs and lower Performance IQs than the HFA group. "The high level of concordance between AS (but not HFA) and a neuropsychological characterization of NLD suggest that the latter can be seen as an adequate neuropsychological marker for AS" (Klin et al., p. 1136). Children with AS typically have the same cognitive and neuropsychological profile as children with NLD (i.e., high VIQ and lower PIQ).

Reitzel and Szatmari (2003) discuss commonly used tests that assess intellectual functioning including the WISC-III (Wechsler, 1991) and the Stanford-Binet Intelligence Scale–Fourth Edition (Thorndike, Hagen, & Sattler, 1986) for children with ASD. While the WJ III COG and UNIT were published in 2001 and 1998, respectively, these instruments were not included in Rietzel and Szatmari's (2003) chapter on cognitive and academic problems in Asperger Syndrome because of the lack of research on how children and adolescents with Asperger Syndrome perform on these intellectual assessment instruments. PubMed and PsycINFO databases were searched for Autism, Asperger Syndrome, Woodcock-Johnson Tests of Cognitive Abilities–Third Edition (Woodcock et al., 2001), and Universal Nonverbal Intelligence Test (Bracken & McCallum, 1998). At the time of this study, there were no research studies utilizing the WJ III COG with children and adolescents with ASD. There was one research study that administered the Analogic Reasoning subtest of the UNIT (Bracken & McCallum, 1998) and the TONI-3 (Brown et al., 1997) to 35 individuals with autism to determine whether real-world-knowledge deficits affected intelligence scores (Edelson, 2005).

In addition to online database searches, Kevin S. McGrew, Research Director for the Woodcock–Munoz Foundation was contacted to determine if there was any research utilizing the WJ III with ASD children and adolescents in press or published. Dr. McGrew (personal communication, April 24, 2006) reported that he had established and organized a website (http://www.iapsych.com/wj3ewok/map.htm) of all available research he could find that has been published since the WJ III was published. In addition, he was unaware of any studies in progress by other individuals utilizing the WJ III with ASD children and adolescents. This website was searched without finding any research studies utilizing the WJ III with ASD children and adolescents.

Hypotheses

As you can see, there is almost no research with individuals with ASD and how they perform on the WJ III COG or the UNIT. Therefore, the current study attempted to address several research questions. Since individuals with AS perform better on Verbal IQ tasks than individuals with HFA (Barnhill et al., 2000), it was hypothesized that individuals with AS would score higher on the WJ III COG GIA than individuals with HFA. Since HFA individuals appear to perform better on nonverbal tasks than AS individuals (Barnhill et al., 2000) and individuals with AS often have visual-spatial deficits (Klin et al., 1995), it was suspected that HFA individuals would perform higher on nonverbal IQ tasks such as the UNIT Full Scale score than AS individuals. Besides the overall WJ III COG GIA score and the UNIT Full Scale IQ score, comparisons with be made with other scores from both intelligence measures. It was hypothesized that AS individuals would outscore HFA individuals on the Verbal Ability cluster of the WJ III COG. In addition, it was also hypothesized that HFA individuals would score higher than the AS individuals on all the four additional scales from the UNIT including the Memory Quotient, Reasoning Quotient, Symbolic Quotient and Nonsymbolic Quotient since the scales are measures of nonverbal intelligence.

This study is very important to the field of school psychology. As discussed earlier, every child evaluated for possible special education services in a public educational setting is provided a Full and Individual Evaluation in which an intelligence instrument is usually administered. Due to the lack of research utilizing the UNIT and the WJ III COG with children and adolescents diagnosed with an ASD, school psychologists currently do not have researched-based knowledge of how students with ASD perform on these intellectual assessments. School psychologists need to know if individuals with AS, HFA, and PDD-NOS score significantly different on the UNIT and the WJ III COG tests because they might be underestimating or overestimating an individual's intellectual abilities. It is important for school psychologists to learn if there is a pattern of scores on these intellectual assessments based upon diagnosis. If there are significant differences in the patterns on intellectual tests for the three ASD categories, these would likely lead to different intervention strategies. School psychologists could provide recommendations for intervention strategies related to strengths and weaknesses in the intellectual profile of individuals with ASD.

CHAPTER III

METHODS

The data for this study were collected during a comprehensive research project on high functioning autism (HFA) and Asperger syndrome (AS) at Texas Woman's University (TWU) in Denton, Texas. This project was conducted by a research team in the Department of Psychology and Philosophy and was sponsored by grants from the Woodcock-Munoz Foundation, the TWU Office of Research and Sponsored Programs, and the Multi-Ethnic Biomedical Research Support Program.

Participants

Participants for this study were recruited through notices placed in local newspapers in the North Texas area to find children ages 8 to 18 years of age with an Autism Spectrum Disorder (ASD) diagnosis from a physician, licensed psychologist, or pediatric neurologist. In addition, children were screened for inclusion in the study through the use of a questionnaire, modeled after the *Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition-Text Revision* (*DSM-IV-TR*, American Psychiatric Association [APA], 2000) criteria for autism, AS or Pervasive Developmental Disorder, not otherwise specified (PDD-NOS). Participants were required to have IQ ≥ 85 on a previous standard intellectual assessment instrument.

Measures

Woodcock Johnson-III Tests of Cognitive Abilities (WJ III COG). The WJ III COG is a comprehensive, norm-referenced, individually administered assessment designed to measure general and specific cognitive functions (McGrew & Woodcock, 2001). The WJ III COG tests are appropriate for children as young as two years of age to adults up to age 90. The WJ III COG was normed on a sample of 8,818 participants consisting of 1,143 preschool-aged children, 4,783 students in kindergarten through 12th grade, and 1,843 adults who were matched to U.S. demographics relative to geographic region, community size, gender, race, Hispanic origin, and type of school or college (Sandoval, 2003). Students with disabilities were included in the 4,783 students in kindergarten through 12th grade "to the extent that they were included at least part-time in regular classes" (McGrew & Woodcock, 2001). It is unknown what disabilities the students had or if students with an Autism Spectrum Disorder were included in the normative sample.

The WJ III COG provides an overall General Intellectual Ability (GIA) score with a mean of 100 and standard deviation of 15. In addition to GIA, the WJ III COG measures broad abilities or cognitive performance clusters (Verbal Ability, Thinking Ability, and Cognitive Efficiency), and factor cluster scores of seven more narrow abilities including: Comprehension-Knowledge (Gc), Long-Term Retrieval (Glr), Visual-Spatial Thinking (Gv), Auditory Processing (Ga), Fluid Reasoning (Gf), Processing Speed (Gs), and Short-Term Memory (Gsm). The WJ III COG includes a Standard and

Extended (Ext) Battery. For this study, the Extended Battery (Ext) was given which included the following subtests: Verbal Comprehension, Visual-Auditory Learning, Spatial Relations, Sound Blending, Concept Formation, Visual Matching, Numbers Reversed, Auditory Working Memory, General Information, Retrieval Fluency, Picture Recognition, Auditory Attention, Analysis-Synthesis, Decision Speed, and Memory for Words.

The Verbal Ability (Ext) cognitive performance cluster includes the Verbal Comprehension and General Information subtests. Verbal Ability (Ext) cluster measures verbal conceptual knowledge and overall general verbal information (Mather & Woodcock, 2001). The Thinking Ability (Ext) cognitive performance cluster includes the following subtests: Visual-Auditory Learning, Retrieval Fluency, Spatial Relations, Picture Recognition, Sound Blending, Auditory Attention, Concept Formation, and Analysis-Synthesis. Thinking Ability (Ext) measures how "an individual processes information that has been placed in short-term memory but cannot be processed automatically" (Mather & Woodcock, 2001). The Cognitive Efficiency (Ext) cognitive performance cluster includes the Visual Matching, Decision Speed, Numbers Reversed, and Memory for Words subtests. Cognitive Efficiency (Ext) measures the "individual's capacity to hold information in conscious awareness and to perform automatic tasks rapidly" (Mather & Woodcock, 2001).

Comprehension-Knowledge (Gc) factor cluster score consists of the Verbal Comprehension and General Information subtests and measures general information and acquired knowledge (Mather & Jaffe, 2002). Long-Term Retrieval (Glr) factor cluster score consists of Visual-Auditory Learning and Retrieval Fluency and measures the "ability to store information efficiently and retrieve it later through associations" (Mather & Jaffe, p. 6). Visual-Spatial Thinking (Gv) factor cluster score consists of the Spatial Relations and Picture Recognition subtests and measures the "ability to perceive, analyze, synthesize, and think with visual patterns, including the ability to store and recall visual representations" (Mather & Jaffe, p. 6). Auditory Processing (Ga) factor cluster score consists of the Sound Blending and Auditory Attention subtests and measures the "ability to analyze, synthesize, and discriminate auditory stimuli" (Mather & Jaffe, p. 6). Fluid Reasoning (Gf) factor cluster score consists of the subtests Concept Formation and Analysis-Synthesis and measures the "ability to reason, form concepts, and solve problems that often involve unfamiliar information or procedures" (Mather & Jaffe, p. 6). Processing Speed (Gs) factor cluster score consists of subtests Visual Matching and Decision Speed and measures "speed and efficiency in performing automatic or simple cognitive tasks and visual scanning efficiency" (Mather & Jaffe, p. 6). Short-Term Memory (Gsm) factor cluster score consists of Numbers Reversed and Memory for Words subtests and measures the "ability to hold orally presented information in immediate awareness and use it within a few seconds (memory span and working memory)" (Mather & Jaffe p. 6).

GIA reliability across all ages for the Extended Battery of the WJ III COG ranged from .97 to .99. Reliability across all ages for the Verbal Ability (Ext) ranged from .92 to

.98, Thinking Ability ranged from .94 to .98, and Cognitive Efficiency ranged from .90 to .94. Concurrent validity scores on the WJ-III COG tend to be lower that those obtained on other IQ measures, such as the WISC-III (Sandoval, 2003). However, Sandoval acknowledged the WJ III COG could be used with confidence as a measure of intellectual ability for the school-aged populations.

"The theoretical foundation of the WJ III is derived from the Cattell-Horn-Carroll theory of cognitive abilities (CHC theory)" (McGrew & Woodcock, 2001, p. 11). Two major empirically derived sources of research on the structure of human cognitive abilities shaped the development of the WJ III batteries: Factor-analytic studies of Raymond Cattell and John Horn and extant factor-analysis research by John Carroll. Cattell and Horn's research has often been referred to as the Gf-Gc theory (Woodcock, 1990). "Gf-Gc is an acronym for fluid (Gf) and crystallized (Gc) intellectual abilities" (McGrew & Woodcock, 2001, p. 11). Cattell made the distinction between fluid and crystallized intelligence while Horn provided evidence for other broad cognitive abilities, including short-term memory (Gsm), long-term retrieval (Glr), processing speed (Gs), and visual-spatial thinking (Gv). Horn and Stankov (1982) added auditory processing (Ga) to the theory. The WJ-R Tests of Cognitive Ability (Woodcock & Johnson, 1989) included these seven cognitive abilities or factors.

"The second major source is the secondary analysis of the extant factor analysis research by John Carroll that resulted in Carroll's three-stratum theory (Carroll, 1993, 1998)" (McGrew & Woodcock, 2001, p. 11). Carroll's structured human cognitive abilities in a hierarchical model. Carroll identified 69 specific narrow or Stratum I abilities. Stratum II abilities are narrow abilities grouped into broad categories of cognitive abilities. Stratum III was the top of the model which Carroll described a factor referred to as General Intelligence or *g*. These two sources make up the overall CHC theory. "The WJ III is a measurement model of CHC theory" (McGrew & Woodcock, 2001, p. 11).

Universal Nonverbal Intelligence Test (UNIT). The UNIT was "designed to measure fairly the general intelligence and cognitive abilities of children and adolescents from ages 5 years through 17 years who may be disadvantaged by traditional verbal and language-loaded measures" (Bracken & McCallum, 1998, p.1). The UNIT is a multi-faceted non-verbal measure of general intelligence, in which the examiner administers the test without verbal directions using pantomime, gestures and nonverbal demonstrations.

The UNIT consists of six subtests measuring two components of intelligence: Symbolic Memory, Spatial Memory and Object Memory subtests measure the memory component of intelligence while Cube Design, Analogic Reasoning and Mazes subtests measure the reasoning component of intelligence (Bracken & McCallum, 1998). All six subtests make up the Extended Battery of the UNIT which was administered to all participants in the current study. The UNIT was normed on a standardization sample of 2,100 children and adolescents. The sample was stratified and proportionately representative of the United States (U.S.) population, based on the 1995 U.S. census data on sex, race, Hispanic origin, region, community setting, classroom placement, special education services provided and parental educational attainment (Bracken & McCallum). The standardization sample for the UNIT did not contain any children or adolescents diagnosed with an Autism Spectrum Disorder.

Like many other intellectual or cognitive assessments, the UNIT has a Full Scale IQ with a mean of 100 and standard deviation of 15. In addition to the Full Scale IQ, the UNIT provides four additional scales: Memory Quotient, Reasoning Quotient, Symbolic Quotient, and Nonsymbolic Quotient. Bracken & McCallum (1998) report the following descriptions of the four scales in the UNIT manual:

> The Memory Quotient is an index of complex memory functioning involving short-term recall and recognition of both meaningful and abstract material. The Memory Quotient is a measure of memory for content (*what* was seen), location (*where* it was seen), and sequence (the *order* in which it was seen). The Reasoning Quotient is an index of thinking and problem-solving abilities, for both familiar and unfamiliar situations. The Reasoning Quotient is a measure of pattern processing, understanding of relationships and planning abilities. The Symbolic Quotient is an index of an individual's ability to solve problems that involve meaningful material and whose solutions lend themselves to internal verbal mediation, including labeling, organizing, and categorizing. The Nonsymbolic Quotient is an index of an individual's ability to solve problems involving abstract material or material that is not very meaningful and whose solutions are not conducive to verbal mediation (p. 4).

For the standardization sample, reliability coefficients for the Extended Battery were as follows: Full Scale range from .91 to .94, Memory Quotient range from .86 to .92, Reasoning Quotient range from .84 to .88, Symbolic Quotient range from .83 to .92 and Nonsymbolic Quotient range from .84 to .89 (Bracken & McCallum, 1998).

A concurrent validity study was conducted between the UNIT and the WISC-III using samples of Native American children who were labeled mentally retarded, learning disabled, or gifted (reported in Bandalos, 2001). The correlations between the UNIT and the WISC-III Full Scale scores were in the mid to high .80s (Bandalos, 2001). Although this study and other studies with different intelligence tests had small samples of children, Bandalos found evidence to support the validity of the UNIT as a measure of intelligence that shares variance with the WISC-III, the Woodcock-Johnson Psycho-Educational Battery-Revised (WJ-R, Woodcock & Johnson, 1989), the Kaufman Brief Intelligence Test (K-BIT, Kaufman & Kaufman, 1990), and the Test of Nonverbal Intelligence-Second Edition (TONI-2, Brown, Sherbenou, & Johnsen, 1990).

Procedure

Most participants completed a battery of tests across one day of assessment. Some participants fatigued easily and had to return to complete the battery of tests. Tests were counterbalanced across participants to prevent order effects in the presentation of measures, fatigue, or carryover effects.

For the purposes of this study, results of the performance from the Extended Battery of both the UNIT and the WJ III COG were used to compare scores based upon diagnosis (i.e., PDD-NOS, HFA, or AS). Analyses of Variance (ANOVAs) were conducted to test for differences among the three diagnostic groups (PDD-NOS, HFA, and AS) on the overall measure of intelligence on the UNIT Full Scale and WJ III COG GIA. For significant overall Fs, a Scheffé post hoc test was conducted to determine where the significant differences exist between the three groups. The Scheffé test is customarily used with unequal sample sizes (Glass & Hopkins, 1996).

Results from the Extended Battery of both the UNIT and the WJ III COG compared scores based upon diagnosis (i.e., PDD-NOS, HFA, or AS). Analyses of Variance (ANOVAs) and Multivariate Analyses of Variance (MANOVAs) were conducted to test for differences among the three diagnostic groups (PDD-NOS, HFA, and AS) on the various measures of intelligence on the UNIT and WJ III COG. When significant univariate effects were found, Scheffé post hoc tests were utilized to determine where the significant differences existed between the three groups.

CHAPTER IV

RESULTS

When children and adolescents are diagnosed with an Autism Spectrum Disorder (ASD), an intelligence test is typically administered as part of the full evaluation. While a generous amount of research has focused upon how children and adolescents with an ASD perform on other intelligence instruments (Barnhill, Hagiwara, Myles, & Simpson, 2000), very little research has explored the Universal Nonverbal Intelligence Test (UNIT) and the Woodcock-Johnson III Tests of Cognitive Abilities (WJ III COG) with ASD. This study investigated the intellectual assessment of individuals with high-functioning autism (HFA), Asperger's Syndrome (AS), and Pervasive Developmental Disorder, Not Otherwise Specified (PDD-NOS) utilizing the UNIT and the WJ III COG. Specifically, this study determined if there are significant differences on overall IQ scores for the WJ III COG (GIA) and the UNIT (Full Scale IQ) between three different diagnostic categories of HFA, AS, and PDD-NOS, as well as on the subscale scores of these tests.

Demographic Characteristics

Sixty-five children ranging from 8 to 18 years of age participated in the study and had a mean age of 11.42 years ($SD = 2.89$). The majority of participants were male (86.2%) and Caucasian (89.2%). Sixty percent of the children were between 8 and 11 years old. More than half of the participants were diagnosed with AS (61.5%), followed by HFA (23.1%), and PDD-NOS (15.4%) (see Table 1).

Table 1

Frequencies and Percentages of Demographic Variables (N = 65)

Variable	Frequency	%
Gender		
Male	56	86.2
Female	9	13.8
Age		
8	13	20
9	8	12.3
10	6	9.2
11	12	18.5
12	5	7.7
13	6	9.2
14	4	6.2
15	3	4.6
16	3	4.6
17	3	4.6
18	2	3.1
Ethnicity		
Caucasian	58	89.2
African-American	3	4.6
Hispanic	4	6.2
Diagnosis		
HFA	15	23.1
AS	40	61.5
PDD-NOS	10	15.4

WJ III COG GIA

A one-way Analysis of Variance (ANOVA) on the overall WJ III COG GIA score between the three diagnostic categories (i.e., HFA, AS, and PDD-NOS) was not significant, $F(2, 61) = 2.19$, $p=.121$. Children diagnosed with HFA ($M = 99.07$, $SD = 15.6$), AS ($M = 105.36$, $SD = 18.68$) or PDD-NOS ($M = 93$, $SD = 16.80$) did not have significantly different overall WJ III COG GIA scores.

UNIT Full Scale

An additional one-way ANOVA on the overall UNIT Full Scale score between the three diagnostic categories (i.e., HFA, AS, and PDD-NOS) was also not significant, $F(2, 59) = .55$, $p=.58$. HFA ($M = 102.23$, $SD = 9.35$), AS ($M = 102.56$, $SD = 17.68$), and PDD-NOS ($M = 96.8$, $SD = 13.547$) participants did not have significantly different overall UNIT Full Scale scores.

UNIT Additional Scales

A one-way Multivariate Analysis of Variance (MANOVA) on the four additional scales of the UNIT between the three diagnostic categories revealed a significant multivariate test, $F(8, 112) = 2.93$, $p < .01$, indicating that at least two of the diagnoses differed on at least one of the subscales. As shown in Table 2, examination of the univariate analyses revealed a significant difference only for the UNIT Reasoning Quotient, $F(2, 62) = 3.63$, $p < .05$. Scheffé post hoc tests revealed that AS ($M = 108.44$, $SD = 15.50$) scored significantly higher on the UNIT Reasoning Quotient than PDD-NOS ($M = 95.3$, $SD = 11.97$), $p < .05$.

Table 2

Average UNIT Additional Scales Scores between HFA, AS, and PDD-NOS

	N	Mean	*SD*	*F*	*P*
UNIT Memory				.08	0.921
HFA	13	96.15	13.11		
AS	39	96.69	18.23		
PDD-NOS	10	98.90	17.94		
UNIT Reasoning				3.63	.033
HFA	13	108.38[ab]	10.53		
AS	39	108.44[a]	15.50		
PDD-NOS	10	95.30[b]	11.97		
UNIT Symbolic				.61	.547
HFA	13	97.08	10.91		
AS	39	102.10	15.03		
PDD-NOS	10	100.90	14.60		
UNIT Nonsymbolic				2.29	.110
HFA	13	107.15	9.16		
AS	39	102.82	18.49		
PDD-NOS	10	93.00	11.55		

Note: Means with different superscripts differed significantly by Sheffé post hoc test, $p < .05$.

UNIT Reasoning Quotient

The Reasoning Quotient is made up of three subtests from the UNIT, Cube Design, Analogic Reasoning, and Mazes. A one-way MANOVA on the three subtests of the UNIT Reasoning Quotient between the three diagnostic categories revealed a significant multivariate test, $F(6, 114) = 3.22$, $p < .05$. Examination of the univariate analyses revealed significant differences between the diagnoses on the Mazes subtest (see Table 3). Post hoc examination of the mean scores revealed that AS (M = 10.18, SD = 2.59) and HFA (M = 10.38, SD = 3.38) scored significantly higher on the UNIT Mazes subtest than PDD-NOS (M = 7.50, SD = 2.68), $p < .05$.

Table 3

Average UNIT Reasoning Quotient Subtest Scores between HFA, AS, and PDD-NOS

Diagnosis	N	Mean	SD	F	p
Cube Design				1.76	.181
HFA	13	12.54	3.10		
AS	39	11.79	3.68		
PDD-NOS	10	9.90	2.77		
Analogic Reasoning				1.30	.282
HFA	13	10.92	2.81		
AS	39	11.92	2.87		
PDD-NOS	10	10.60	1.96		
Mazes				4.06	.022
HFA	13	10.38[a]	3.38		
AS	39	10.18[a]	2.59		
PDD-NOS	10	7.50[b]	2.68		

Note: Means with different superscripts differed significantly by Sheffé post hoc test, $p < .05$.

WJ III COG Performance Clusters

An additional one-way Multivariate Analysis of Variance (MANOVA) on the WJ III COG performance cluster scores for the three diagnostic categories did not reveal a significant multivariate test, $F(6, 118) = 1.48$, p=.189. These results indicate that participants in the three diagnoses did not significantly differ across the WJ III COG Performance Clusters (see Table 4).

Table 4

Average WJ III COG Performance Clusters Scores between HFA, AS, and PDD-NOS

Diagnosis	*N*	Mean	*SD*	*F*	*p*
WJ III COG Verbal Ability				4.12	.021
HFA	15	100.40	16.89		
AS	39	108.10	18.36		
PDD-NOS	10	91.20	13.21		
WJ III COG Thinking Ability				1.19	.312
HFA	15	105.93	14.73		
AS	39	107.95	16.82		
PDD-NOS	10	98.80	19.30		
WJ III COG Cognitive Efficiency				.562	.573
HFA	15	92.27	14.10		
AS	39	96.28	19.22		
PDD-NOS	10	90.60	15.70		

WJ III COG Cognitive Factors

An additional one-way MANOVA on the WJ III COG Cognitive Factor scores for the three diagnostic categories did not reveal a significant multivariate test, $F(14, 110) = 1.66$, $p=.076$. These results indicate that participants in the three diagnoses did not significantly differ across the seven WJ III COG Cognitive Factors (see Table 5).

Table 5

Average WJ III COG Cognitive Factor Scores between HFA, AS, and PDD-NOS

Diagnosis	*N*	Mean	*SD*	*F*	*p*
Comprehension-Knowledge				4.12	.021
HFA	15	100.40	16.89		
AS	39	108.10	18.36		
PDD-NOS	10	91.20	13.21		
Long-Term Retrieval				.61	.548
HFA	15	96.80	13.11		
AS	39	102.62	18.94		
PDD-NOS	10	97.80	27.31		
Visual-Spatial				1.12	.334
HFA	15	107.33	8.18		
AS	39	103.08	12.04		
PDD-NOS	10	101.50	8.58		
Auditory Processing				3.44	.038
HFA	15	111.00	15.09		
AS	39	107.36	14.57		
PDD-NOS	10	94.90	19.99		
Fluid Reasoning				1.18	.316
HFA	15	101.07	18.32		
AS	39	107.62	17.08		
PDD-NOS	10	100.00	20.06		
Processing Speed				.44	.644
HFA	15	87.87	14.55		
AS	39	92.72	22.17		
PDD-NOS	10	88.20	14.01		
Short-Term Memory				.357	.701
HFA	15	98.20	13.21		
AS	39	99.85	16.17		
PDD-NOS	10	95.20	17.54		

Hypotheses

It was hypothesized that individuals with AS would score higher on the WJ III COG GIA than individuals with HFA since individuals with AS performed better on Verbal IQ tasks than individuals with HFA (Barnhill et al., 2000). The results of this study did not support this hypothesis. There were no significant differences between HFA and AS scores on the WJ COG GIA.

Since HFA individuals appear to perform better on nonverbal tasks than AS individuals (Barnhill et al., 2000) and individuals with AS often have visual-spatial deficits (Klin et al., 1995), it was suspected that HFA individuals would perform higher on nonverbal IQ tasks, such as the UNIT Full Scale score than AS individuals. This hypothesis was also not supported by the results of this study. There were no significant differences between HFA and AS on the UNIT Full Scale IQ.

It was also hypothesized that AS individuals would outscore HFA individuals on the Verbal Ability cluster of the WJ III COG. The results of this study did not support this hypothesis. There were no significant differences between HFA and AS.

In addition, it was hypothesized that HFA individuals would score higher than the AS individuals on all four additional scales from the UNIT including the Memory Quotient, Reasoning Quotient, Symbolic Quotient and Nonsymbolic Quotient because these scales are a measure of nonverbal intelligence tasks. For all four additional UNIT scales, this hypothesis was not supported. There were no differences between HFA and AS on the UNIT Memory Quotient, Reasoning Quotient, Symbolic Quotient, or

Nonsymbolic Quotient. However, significant differences were found on the UNIT Reasoning Quotient between AS and PDD-NOS with AS performing better than PDD-NOS.

Summary

The present study investigated ASD participants and their cognitive abilities. The utilization of the WJ III COG and the UNIT provided data to explore whether there were differences within these two cognitive assessments by the participants diagnosis (i.e., PDD-NOS, AS, or HFA). Results showed no significant results between HFA and AS participants on any scores of either the UNIT or the WJ III COG. However, there were significant results related to either HFA or AS vs. PDD-NOS participants whom always produced a lower performance. The findings are further discussed in Chapter 5.

CHAPTER V

DISCUSSION

The purpose of this study was to add to the existing body of research regarding intellectual assessment of individuals with high-functioning autism (HFA) and Asperger Syndrome (AS). There has been little or no research regarding intellectual assessment of individuals with an Autism Spectrum Disorder (ASD) as measured by the Woodcock-Johnson Tests of Cognitive Abilities–Third Edition (WJ III COG) and the Universal Nonverbal Intelligence Test (UNIT). This study attempted to determine if there were significant differences between overall IQ scores for the WJ III COG (GIA) and the UNIT (Full Scale IQ) for three different diagnostic categories of HFA, AS, and Pervasive Developmental Disorder, Not Otherwise Specified (PDD-NOS). In addition, the four additional tests on the UNIT (i.e., Memory Quotient, Reasoning Quotient, Symbolic Quotient, and Nonsymbolic Quotient), the WJ III COG Performance Clusters [i.e., Verbal Ability, Thinking Ability, and Cognitive Efficiency), and the seven Cognitive Factors (i.e., Comprehension-Knowledge (Gc), Long-Term Retrieval (Glr), Visual-Spatial Thinking (Gv), Auditory Processing (Ga), Fluid Reasoning (Gf), Processing Speed (Gs), and Short-Term Memory (Gsm)] were compared to determine if there were significant differences by diagnosis (i.e., HFA, AS, and PDD-NOS). Additional analyses were also performed for each of the seven Cognitive Factors to determine if there are significant differences between the two subtests for each factor. Sixty five participants age 8 to 18 years of age participated in this study. The overall results of this study will be discussed.

Hypotheses

As discussed in the previous chapter, all the hypotheses proposed prior to the completion of the study were not supported by the results of this study. There were no significant differences on any measure of the WJ III COG or the UNIT between HFA and AS children and adolescents. One reason for lack of significant results between these two groups might have been due to uneven numbers of participants between the two groups (i.e., HFA and AS). This study had a total of 65 participants, of which 40 were AS and 15 were HFA.

Another possible explanation for lack of significance may be that differences between cognitive abilities for HFA and AS do not exist. Previous research has found no significant differences between AS and HFA individuals on other intellectual assessments such as the WISC-IV (Klin et al, 2005). Cognitive abilities on the UNIT and the WJ III COG may be another area of functioning where there are no differences between HFA and AS. This finding may lend support to the notion that there really are no differences between the diagnoses of AS and HFA, including the area of cognitive abilities.

Additional Findings

There were some significant findings in this study that were unexpected. For example, there were significant differences on the UNIT Reasoning Quotient between AS (M = 108.44, SD = 15.50) and PDD-NOS (M = 95.3, SD = 11.97) with AS performing better than PDD-NOS. Reasoning has been considered a cornerstone of intelligence or core thinking ability and broad-based reasoning tests have been an effective measure of general intelligence (Carroll, 1993; Bracken & McCallum, 1998). The UNIT Reasoning Quotient is the ability to use information to solve problems including block design tasks, matrices and analogies, and maze-completion tasks. The Reasoning Quotient is a measure of pattern processing, understanding of relationships and planning abilities (Bracken & McCallum, 1998). Since the UNIT Reasoning Quotient was significantly different between at least two groups, a multivariate analysis was completed to determine which of the three subtests of the Reasoning Quotient (i.e., Cube Design, Analogic Reasoning, and Mazes) produced the significantly different scores. AS and HFA scored significantly higher on the UNIT Mazes subtest than PDD-NOS. AS and HFA participants appeared to have better nonverbal problem solving and planning abilities than the PDD-NOS group.

Limitations

There are several limitations of this study including: number of participants, high Caucasian percentage of participants, and current diagnosis. While the number of participants in this study was actually higher than most of the articles reviewed for this study, the number of actual participants in some of the diagnostic categories was low from a statistical standpoint. Since this study is the first to examine differences in WJ III COG scores by diagnosis of ASD, it is difficult to generalize the results of this study to all children and adolescents with an ASD based only upon 65 participants. In addition, there were considerably more participants in the AS group (n = 40) than the HFA and PDD groups (n = 15 and n = 10, respectively).

The percentage of Caucasian participants was 89.2%. In a recent study by the U.S. Centers for Disease Control and Prevention, Hispanics had lower autism rates; however, this may be due to lack of access to health-care (Associated Press, 2006). Due to the high percentage of Caucasian participants, the results of this study cannot be generalized to minority populations with ASD.

Parents brought a copy of a report with their child's current diagnosis (i.e., AS, HFA, or PDD-NOS). In addition, participants were screened for inclusion in the study through the use of a questionnaire, modeled after the *Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition-Text Revision* (*DSM-IV-TR*, American Psychiatric Association [APA], 2000) criteria for autism, AS or Pervasive Developmental Disorder, not otherwise specified (PDD-NOS). Researchers have found poor agreement between diagnostic criteria used and the subsequent diagnosis an individual receives. Klin et al. (2005) reported more than half of the participants in their study received two different diagnoses (i.e., PDD-NOS, HFA or AS) when using three different diagnostic approaches. Diagnoses given to current participants in this study came from numerous sources (i.e., physician, licensed psychologist, or pediatric neurologist). It is unknown if participants in this study were diagnosed using the same diagnostic criteria.

The number of male participants (n = 56) far outweighed the number of female participants (n = 9) in this study by a 6.2 to 1 margin. This ratio is similar to ratios of male vs. female rates of ASD found in the literature. Boys are nearly four times more likely than girls to be identified with an Autism Spectrum Disorder (Associated Press, 2006).

Future Research

Since this study is the first to examine differences in WJ III COG and UNIT scores by diagnosis of ASD, further research is needed to address the three diagnostic categories in the area of intellectual function. Very little research exists in the area of cognitive functioning for PDD-NOS individuals (Klin et al., 2005). Further research needs to seek out more participants from minority groups in order to be able to generalize the results found in the study. Future research also needs to ensure more participants in all three ASD diagnoses since there were considerably more participants in the AS group (n = 40) than the HFA and PDD groups (n =15 and n = 10, respectively) in this study. The development of consensus related to the definition of AS and diagnostic criteria is needed in order to determine once and for all if the terms AS and HFA should be used interchangeably or are they are truly different diagnoses.

Summary

The purpose of this study is to add to the existing body of research regarding intellectual assessment of individuals with high-functioning autism (HFA) and Asperger Syndrome (AS). All the hypotheses proposed prior to the completion of the study were not supported by the results of this study. There were no significant differences on any measure of the WJ III COG or the UNIT between HFA and AS children and adolescents.

Macintosh and Dissanayake (2004) stated there are very few qualitative differences between HFA and AS. Szatmari (1998) reported lack of consensus that AS was different from HFA. Klin et al. (2005) suggest that the comparison of AS across studies using different diagnostic criteria is virtually impossible. This may be one of the reasons for mixed results in studies comparing HFA to AS individuals. Researchers have used different diagnostic criteria so essentially the participants are not the same. There may be no differences between HFA and AS depending on which diagnostic criteria the researchers used. The results of this current study support the notion that HFA and AS are similar in the area of cognitive functioning.

The topic of this research study is a new area of research that needs to continue. The debate of whether HFA and AS are the same disorder or should be distinct diagnostic categories needs to be settled. Researchers and school psychologists need to continue to explore if HFA and AS are the same or different in many areas including cognitive functioning. The implications of this research might change the way school psychologists practice for years to come.

REFERENCES

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed., text revision). Washington, DC: Author.

Associated Press. (2006, May 5). 300,000 U.S. children diagnosed with autism. Retrieved June 7, 2006, from http://www.msnbc.msn.com/id/12629664/from/ET

Attwood, T. (1998). *Asperger's syndrome: A guide for parents and professionals.* Philadelphia: Jessica Kingsley Publishers.

Bandalos, D. L. (2001). Test review of Universal Nonverbal Intelligence Test. From B. S. Plake & J. C. Impara (Eds.), *The fourteenth mental measurements yearbook* [Electronic version]. Retrieved July 19, 2005, from the Buros Institute's *Test Reviews Online* website: http://www.unl.edu/buros

Barnhill, G., Hagiwara, T., Myles, B. S., & Simpson, R. L. (2000). Asperger syndrome: A study of the cognitive profiles of 37 children and adolescents. *Focus on Autism and Other Developmental Disabilities, 15*, 146-153.

Bracken, B.A., & McCallum, R.S. (1998). *Manual for the Universal Nonverbal Intelligence Test.* Itasca, IL: Riverside Publishing.

Brown, L., Sherbenou, R. J., & Johnsen, S. K. (1990). *Test of Nonverbal Intelligence-Second Edition.* Austin, TX: PRO-ED.

Brown, L., Sherbenou, R. J., & Johnsen, S. K. (1997). *Test of Nonverbal Intelligence Third Edition.* Austin, TX: PRO-ED.

Carroll, J. B. (1993). *Human cognitive abilities: A survey of factor-analytic studies.* New York: Cambridge University Press.

Carroll, J. B. (1998). Human cognitive abilities: A critique. In J. J. McArdle & R. W. Woodcock (Eds.), *Human cognitive abilities in theory and practice* (pp. 5-24). Mahwah, NJ: Lawrence Erlbaum.

Chan, A. S., Cheung, J., Leung, W. W., Cheung, R., & Cheung, M. (2005). Verbal expression and comprehension deficits in young children with autism. *Focus on Autism and Other Developmental Disabilities, 20*, 117-124.

Edelson, M. G. (2005). A car goes in the garage like a can of peas goes in the refrigerator: Do deficits in real-world knowledge affect the assessment of intelligence in individuals with autism? *Focus on Autism and Other Developmental Disabilities, 20*, 2-9.

Fombonne, E. (2003). Epidemiological surveys of autism and other pervasive developmental disorders: An update. *Journal of Autism and Developmental Disorders, 33*, 365-382.

Frith, U. (1991). Asperger and his syndrome. In U. Frith (Ed.) *Autism and Asperger syndrome* (pp. 1-36). New York: Cambridge University Press.

Gillberg, C., & Gillberg, I. C. (1989). Asperger syndrome – Some epidemiological considerations: A research note. *Journal of Child Psychology and Psychiatry, 30,* 631-638.

Glass, G. V., & Hopkins, K. D. (1996). *Statistical methods in education and psychology* (3rd ed.). Needham Heights, MA: Allyn & Bacon.

Heerey, E. A., Capps, L. M., Keltner, D., & Kring, A. M. (2005). Understanding teasing: Lessons from children with autism. *Journal of Abnormal Child Psychology, 33*, 55-68.

Horn, J. L., & Stankov, L. (1982). Auditory and visual factors of intelligence. *Intelligence, 6,*165-185.

Howlin, P. (2003). Outcome in high-functioning adults with autism with and without early language delays: Implications for the differentiation between autism and Asperger syndrome. *Journal of Autism and Developmental Disorders, 33*, 3-13.

Kaufman, A. S., & Kaufman, N. L. (1990). *Kaufman Brief Intelligence Test.* Circle Pines, MN: American Guidance Service.

Klin, A., Pauls, D., Schultz, R., & Volkmar, F. (2005). Three diagnostic approaches to Asperger syndrome: Implications for research. *Journal of Autism and Developmental Disorders, 35(2),* 221-234.

Klin, A., Volkmar, F. R., Sparrow, S. S., Cicchetti, D. V., & Rourke, B. P. (1995). Validity and neuropsychological characterization of Asperger syndrome. *Journal of Child Psychology and Psychiatry, 36,* 1127-1140.

Mather, N., & Jaffe, L. E. (2002). *Woodcock-Johnson III: Reports, recommendations and strategies*. New York: John Wiley & Sons.

Mather, N., & Woodcock, R. W. (2001). Examiner's Manual. *Woodcock-Johnson III Tests of Cognitive Abilities*. Itasca, IL: Riverside Publishing.

McGrew, K. S., & Woodcock, R. W. (2001). Technical Manual. *Woodcock-Johnson III.* Itasca, IL: Riverside Publishing.

Macintosh, K.E., & Dissanayake, C. (2004). Annotation: The similarities and differences between autistic disorder and Asperger's disorder: A review of the empirical evidence. *Journal of Child Psychology and Psychiatry, 45,* 421-434.

Ozonoff, S., & Griffith, E. M. (2000). Neuropsychological function and the external validity of Asperger syndrome. In A. Klin, F. R., Volkmar, & S. S. Sparrow (Eds.), *Asperger syndrome* (pp. 72-96). New York: Guilford Press.

Ozonoff, S., Rogers, S. J., & Pennington, B. F. (1991). Asperger's syndrome: Evidence of an empirical distinction from high-functioning autism. *Journal of Child Psychology and Psychiatry, 32*, 1107-1122.

Prior, M. (2003). Is there an increase in the prevalence of autism spectrum disorders? *Journal of Pediatric Child Health, 39,* 81-82.

Reitzel, J., & Szatmari, P. (2003). Cognitive and academic problems. In M. Prior (Ed.), *Learning and behavior problems in Asperger's syndrome* (pp. 35-54). New York: Guilford Press.

Sandoval, J. (2003). Test review of the Woodcock-Johnson III. From B. S. Plake, J. C. Impara, & R. A. Spies (Eds.), *The fifteenth mental measurements yearbook* [Electronic version]. Retrieved April 17, 2005, from the Buros Institute's *Test Reviews Online* website: http://www.unl.edu/buros

Sattler, J. M., & Saklofske, D. H. (2001). Interpreting the WISC-III. In J. M. Sattler (Ed.), *Assessment of children: Cognitive applications* (4th ed., pp. 298-334). San Diego, CA: Jerome M. Sattler, Publisher, Inc.

Szatmari, P. (1998). Differential diagnosis of Asperger syndrome. In E. Schopler & G. B. Mesibov (Eds.), *Asperger syndrome or high-functioning autism?* (pp. 61-76). New York: Plenum.

Szatmari, P., Bremner, R., & Nagy, J. (1989). Asperger's syndrome: A review of clinical features. *Canadian Journal of Psychiatry, 153*, 783-791.

Texas Education Agency Office of Special Education. (2004, July). *Special education rules and regulations*. Retrieved March 17, 2006, from the Texas Education Agency Web site: http://www.tea.state.tx.us/special.ed/rules/pdf/sbs2004.pdf

Thorndike, R. L., Hagen, E. P., & Sattler, J. M. (1986). *Guide for administering and scoring the Stanford-Binet Intelligence Scale: Fourth Edition*. Chicago: Riverside Publishing.

Wechsler, D. (1991). *Manual for the Wechsler Intelligence Scale for Children–Third Edition*. San Antonio, TX: Psychological Corporation.

WJ III EWOK (Evolving Web of Knowledge). (n.d.). Retrieved June 4, 2006, from http://www.iapsych.com/wj3ewok/map.htm

Wing, L. (1981). Asperger's syndrome: A clinical account. *Psychological Medicine*, *11*, 115-130.

Wing, L. (2000). Past and future of research on Asperger syndrome. In A. Klin, F. R. Volkmar, & S. S. Sparrow (Eds.), *Asperger syndrome* (pp. 418-432). New York: Guilford Press.

Woodcock, R.W. (1990). Theoretical foundations of the WJ-R measures of cognitive ability. *Journal of Psychoeducational Assessment, 8,* 231-258.

Woodcock, R. W., & Johnson, M. B. (1989). *Woodcock-Johnson Psychoeducational Battery-Revised.* Itasca, IL: Riverside Publishing.

Woodcock, R.W., McGrew, K.S., & Mather, N. (2001). *Woodcock-Johnson III Tests of Cognitive Abilities*. Itasca, IL: Riverside Publishing.

World Health Organization. (1992). *ICD-10. International statistical classification of diseases and related health problems (10th rev.).* Geneva: Author.

APPENDIX A

Diagnostic Criteria for Autistic Disorder

A. A total of six (or more) items from (1), (2), and (3), with at least two from (1), and one each from (2) and (3):
   1. qualitative impairment in social interaction, as manifested by at least two of the following:
      a. marked impairment in the use of multiple nonverbal behaviors such as eye-to-eye gaze, facial expression, body postures, and gestures to regulate social interaction
      b. failure to develop peer relationships appropriate to developmental level
      c. a lack of spontaneous seeking to share enjoyment, interests, or achievements with other people (e.g., by a lack of showing, bringing, or pointing out objects of interest)
      d. Lack of social or emotional reciprocity
   2. qualitative impairments in communication as manifested by at least one of the following:
      a. delay in, or total lack of, the development of spoken language (not accompanied by an attempt to compensate through alternative modes of communication such as gesture or mime).
      b. in individuals with adequate speech, marked impairment in the ability to initiate or sustain a conversation with others
      c. stereotyped and repetitive use of language or idiosyncratic language
      d. lack of varied, spontaneous make-believe play or social imitative play appropriate to developmental level
   3. restricted repetitive and stereotyped patterns of behavior, interests, and activities, as manifested by at least one of the following:
      a. encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus
      b. apparently inflexible adherence to specific, nonfunctional routines or rituals
      c. stereotyped and repetitive motor mannerisms (e.g., hand or finger flapping or twisting, or complex whole-body movements)
      d. persistent preoccupation with parts of objects
   4. delays or abnormal functioning in at least one of the following areas, with onset prior to age 3 years: (1) social interaction, (2) language as used in social communication, or (3) symbolic or imaginative play.
   5. The disturbance is not better accounted for by Rhett's Disorder or Childhood Disintegrative Disorder.

Note: From *DSM-IV-TR* (2000, p. 75)

APPENDIX B

Diagnostic Criteria for Asperger's Disorder

Diagnostic criteria for Asperger's Disorder

A. Qualitative impairment in social interaction, as manifested by at least two of the following:
   1. marked impairment in the use of multiple nonverbal behaviors such as eye-to-eye gaze, facial expressions, body postures, and gestures to regulate social interaction
   2. failure to develop peer relationships appropriate to developmental level
   3. a lack of spontaneous seeking to share enjoyment, interests, or achievements with other people (e.g., by a lack of showing, bringing, or pointing out objects of interest to other people)
   4. lack of social or emotional reciprocity

B. Restricted repetitive and stereotyped patterns of behavior, interests and activities, as manifested by at least one of the following:
   1. encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus
   2. apparently inflexible adherence to specific, nonfunctional routines or rituals
   3. stereotyped and repetitive motor mannerisms (e.g., hand or finger flapping or twisting, or complex whole-body movements)
   4. persistent preoccupation with parts of objects

C. The disturbance causes clinically significant impairment in social, occupational, or other important areas of functioning.

D. There is no clinically significant general delay in language (e.g., single words used by age 2 years, communicative phrases used by age 3 years).

E. There is no clinically significant delay in cognitive development or in the development of age-appropriate self-help skills, adaptive behavior (other than in social interaction), and curiosity about the environment in childhood.

F. Criteria are not met for another specific Pervasive Developmental Disorder or Schizophrenia.

Note: From *DSM-IV-TR* (2000, p. 84)

APPENDIX C

Diagnostic Criteria for Pervasive Developmental Disorder Not Otherwise Specified

Diagnostic criteria for Pervasive Developmental Disorder Not Otherwise Specified

(Including Atypical Autism)

This category should be used when there is a severe and pervasive impairment in the development of reciprocal social interaction associated with impairment in either verbal or nonverbal communication skills or with the presence of stereotyped behavior, interest, and activities, but the criteria are not met for a specific Pervasive Developmental Disorder, Schizophrenia, Schizotypal Personality Disorder, or Avoidant Personality Disorder. For example, this category includes "atypical autism" – presentations that do not meet the criteria for Autistic Disorder because of late age at onset, atypical symptomatology, or subthreshold symptomatology, or all of these.

Note: From *DSM-IV-TR* (2000, p. 84)