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Autism Assessment Scale for Children (AASC): The Development of a DSM-V Aligned Questionnaire to Screen School-Aged Children for High Functioning Autism

Christine Hebert
Old Dominion University

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by

Christine Hebert

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Approved by:

Jennifer Kidd (Chairman)

Shana Pribesh (Member)

Jonna Bobzien (Member)

ABSTRACT

Autism Assessment Scale for Children (AASC): The Development of a DSM-V Aligned Questionnaire to Screen School-Aged Children for High Functioning Autism

Christine Hebert
Old Dominion University, 2014
Director: Jennifer Kidd, Ph.D.

The purpose of this dissertation is to analyze the latent factor structure underlying the Ellis Functional Assessment (EFA) for children with high-functioning autism (HFA), to compare the latent factor structures for under-identified subgroups of children (older children, gifted children, female children), and to design a pre-screening assessment for HFA based on those results. The scope of the study is limited to children who have been identified as having HFA and whose parents completed the EFA while patients of a mid-Atlantic clinical practice specializing in autism spectrum disorders. The methodology uses preliminary factor analysis and confirmatory factor analysis to both analyze the data from seven years of clinical practice and develop a new pre-screening assessment. Findings help to explain differences and commonalities between the under-identified subgroups with HFA and the rest of the HFA population. The largest limitation to this study is the sample size (n = 380) which though large for an autism study, is small for the use of preliminary factor analysis relative to the number of items contained in the EFA. This study supports prior research identifying differences between the under-identified subgroups and the identified population with HFA and contributes additional possible identifying differences. This study also develops a potential pre-screening assessment for

HFA that is sensitive to under-identified subgroups, reflects the factor structure of the Ellis Functional Assessment, conforms to DSM-V, and has excellent internal reliability.

KEYWORDS: autism, female, gifted, older, high-functioning autism, DSM-V, Pre-screening assessment, ASD, Asperger's Syndrome

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CHAPTER 1

Introduction

Statement of the Problem

The under-identification of school age children with autism spectrum disorders is an ongoing educational problem in our schools (Morrier & Hess, 2010). Autistic spectrum disorders (ASD) is defined as a range of neurodevelopmental disorders characterized by social deficits, communication deficits, and stereotyped or repetitive behaviors (Wilkerson, 2010). According to Kim and colleagues, 2.64% of the total school age population showed some symptoms of ASD while only .75% of the school age population was identified (Kim, Leventhal, Koh, Fombonne, Laska, Lim et al., 2011). In the population identified as having ASD, the ratio of males to females is 4:1. It was noted in the study by Kim and colleagues that the proportion of female students in the undiagnosed population was twice as high as in the diagnosed population. Additionally, 12% of this total undiagnosed population had IQs over 120 points.

Although the social deficits of ASD are lifelong and persist through adolescence and adulthood, the overall trajectory for many of the outward symptoms of ASD is improvement (Seltzer, Shattuch, Abbeduto, & Greenberg, 2004). Maladaptive behaviors decrease significantly over time (Shattuch, Seltzer, Greenberg, Bolt, Kring, Lounds, et al, 2007). Additionally, there are documented improvements in communication from childhood to adolescence (Seltzer et al., 2004). In addition, individuals with high-functioning autism (HFA) show more improvement over time than individuals with low functioning autism (LFA) (Shattuch et al., 2007). As many of the current assessments are

normed on younger samples and lower functioning individuals, it is likely that many older children with ASD are not identified by these assessments (Campbell, 2005).

Even with boys and girls counted together, for every three known cases of ASD there are at least two undiagnosed cases (Baron-Cohen et al., 2009). The majority of these children who have not been identified but have high-functioning autism do not have intellectual impairments, and include varying ability levels from average to gifted (Wilkerson, 2010). Another issue making identification difficult is that girls with ASD may not have the same behavioral phenotype as boys with ASD. This may also account, in part, for the differences in the number of girls compared to boys who are diagnosed (Assouline, Nicpon & Doobay, 2009).

For those with ASD who are not identified and given the supports they need as children, growing up can be very difficult (White, Oswald, Ollendick, & Scahill, 2009). David Spicer, a high-functioning adult on the autism spectrum, states that in addition to being bullied and left out of many group activities as a child he had the following experiences in school:

> Academically, elementary and junior high schools were not difficult, except for "penmanship" at which I was awful. What I remember most clearly is how emotionally fragile I was, often bursting into tears to the dismay of my teachers. By high school, I had managed to become bland enough to not attract very much attention, except when a teacher would notice the difference between my very-high performance on standardized aptitude tests and my very-average grades. "Unrecognized potential", they called it (Spicer, 1998, p. 377).

Undiagnosed students may appear to adults as troublemakers because of their social and communication deficits (Cooper and Hanstock, 2009). They are often misdiagnosed with depression, anxiety, or obsessive-compulsive disorder (OCD), which may actually be the result of behavioral attempts to cope with undiagnosed high-

functioning autism (Cooper & Hanstock, 2009). There is a need to identify these young people and provide the educational and support services they need in order to ensure the best educational outcome they can achieve. Currently, there are no prescreening assessments for ASD to help in identifying these individuals.

Thus, there is a demonstrated need for better assessments that can identify high functioning autistic students especially assessments that identify the phenotypic differences that are specific to girls. In addition, there is also a need for an assessment that identifies students of both genders without cognitive impairments, some of whom may be gifted (Baron-Cohen et al., 2009).

Purpose Statement

The purpose of this study is to develop a short pre-screening assessment to assist school staff in deciding when students should be referred to schools' child study teams for a determination of eligibility for special education services under the category of ASD. This assessment, adapted from the Ellis Functional Assessment, should involve input from both a parent/guardian and an educational professional familiar with the student. The assessment should be easy to score and not require specialized training for its implementation. There currently is no pre-screening assessment for high-functioning autism in school-aged children.

Sample

The assessment will be developed by analyzing a medium sample (n = 538) of responses from individuals diagnosed with high-functioning autism who completed the Ellis Functional Assessment for high-functioning autism. The sample comes from seven

years of patient records from a mid-Atlantic counseling service specializing in individuals with ASD.

Ellis Functional Assessment

The EFA contains 272 items and is the result of extensive research from wide variety of sources including recent publications, school system evaluations and many others (Deeley, Harrington & Ellis, 2011). Using this research, Ellis has created an assessment which is easily understood by clinicians, patients, and families alike (Deeley et al., 2011). Each category of the assessment covers either an area of specific difficulties in behaviors or the presence of behaviors that are typical of patients on the autism spectrum. This assessment has established internal content validity and reliability (Deeley et al., 2011).

Research Questions

The following research questions guide this study.

Research Question 1:

What are the latent factors assessed in the Ellis Functional Assessment for high-functioning autism?

a) Do these factors change when considering populations aged 8 – 12 years or aged 13 - 18 years?

b) Do these factors change when considering gifted verses non-gifted populations?

c) Do these factors change when considering only male or female sub-populations?

Research Question 2:

Given the factors found in the EFA, which items are associated with certain identified latent actors?

a) Do these alignments change when considering populations aged 8 – 12 years or aged 14-18 years?

b) Do these alignments change when considering gifted versus non-gifted populations?

c) Do these alignments change when considering only male or female sub-populations?

Research Question 3:

To what degree can a valid 15 to 25 item pre-screening questionnaire for high-functioning autism be developed using these items and factors?

a) Can a single valid assessment be developed or is it necessary to develop multiple pre-screening instruments based on age, gender, or gifted status?

Research in this dissertation will occur in three stages. First, preliminary factor analysis will be used to identify the largest latent factors contained in the EFA for children aged 8 years to 18 years. Preliminary factor analysis will then be done on each subgroup in the study and the results will be compared.

Next, the highest loading items on each factor for each different subgroup will be analyzed and compared for both commonalties and differences. This may show how different factors present for different groups of children.

The third part of the research will be the development of a short, pre-screening assessment for ASD that can be used by schools to evaluate whether or not a student

should be referred to child study teams for an educational evaluation of autism spectrum disorder. This assessment will undergo confirmatory factor analysis to examine how well it reflects the same factorial structure in the EFA. Reliability will be then be computed for the short assessment using Cronbach's Alpha.

Delimitations

The data for this study comes from a database of patient responses to the Ellis Functional Assessment. These records reflect responses from people with high-functioning autism in the mid-Atlantic region. This study focuses on high-functioning autism instead of the entire autism spectrum, as these are the individuals that research shows are the most under identified (Cooper & Hanstock, 2009). Gender, age, and gifted status will also be included as part of the data to address those underserved groups of individuals as identified by literature.

Significance of the Dissertation

The need to assess and provide services to individuals with high-functioning autism are well demonstrated (Barnhill, 2007). It is in an educational setting that the difficulties experienced by these students may become apparent. A simple pre-screening assessment, with input from both a parent and an educator, would provide a practical method for identifying individuals in need of further evaluation. As such, this assessment could serve to increase the identification of students in need of additional special education support and services.

There are potentially tens of thousands of public school students in the United States with ASD who have yet to be identified (Safran, 2008). Most of these students have high-functioning autism (Safran, 2008). In addition, female and gifted students

remain a particularly undiagnosed subset of this population (Lai et al., 2011). It is the hope of this study to design a pre-screening questionnaire with great sensitivity that will allow for the referral of more students for an educational classification of ASD including those students who are twice exceptional.

Organization of the Dissertation

The remainder of the dissertation is organized into four chapters, references, and appendixes in the following manner. Chapter 2 presents a review of related literature dealing with ASD, high-functioning autism, the under identification of high-functioning autism, services these children need, and the development of the questionnaire. Chapter 3 delineates the research design and methodology of the study as well as the procedures followed and the statistical methods used for the study. An analysis of the data and a discussion of the findings are presented in Chapter 4. Chapter 5 contains the summary, conclusions, and recommendations of the study. This document concludes with references and appendixes.

Definition of Terms

HFA – High-functioning autism

EFA - Ellis Functional Assessment

AS – Asperger's Syndrome

LFA- Low Functioning Autism

ASD – Autism Spectrum Disorder

AASC – Autism Assessment Scale for Children

DSM-IVTR - Diagnostic and Statistical Manual of Mental Disorders (4th ed., text rev.).

DSM-V - Diagnostic and Statistical Manual of Mental Disorders (5th ed.)

Gifted – The designation that a school system has identified a child as gifted

SPED – Special Education

Chapter 2

Literature Review

The under-identification of high-functioning autism (HFA) in school age children is an ongoing educational problem in our schools (Morrier & Hess, 2010). There are substantial numbers of children who have not been identified, especially more able students with high-functioning autism (Wilkerson, 2010). It is critically important to identify those children in need of further assessment to reduce the time between symptom appearance and identification (Wilkerson, 2010). Lost time due to under-identification or failing to provide needed services will diminish the developmental potential of children with ASD (Pool & Hourcade, 2011). Today, schools are often the primary source of referral for evaluation for ASD (Ruble, & Akshoomoff, 2010). Unfortunately, more than half the children with autistic impairments, at the same levels as those with an ASD label, are not identified even though they have the same needs for support in educational settings (Russell et al., 2010).

All of the current screening instruments for ASD have demonstrated significant weaknesses, especially the under-identification of HFA (Wilkerson, 2010). This is in large part because the instruments are normed on wider autistic populations which include large numbers of lower-functioning individuals with ASD (Mayes et al., 2012). As the results from research on low-functioning autism cannot be generalized to individuals with high-functioning autism, these normed assessments are often less able to reliably detect HFA (Billstedt et al., 2007). There continues to be a need for a brief, precise, and validated screening assessments for ASD for identifying more subtle autistic symptoms in school-age children (Wilkerson, 2010). The under-identification of students

with HFA denies these students the supportive interventions they need to fully succeed in school (Bauer, 1996). These interventions include speech therapy to help with prosody and affect of speech, as well as social training interventions that help with the social deficits common to students on the autism spectrum (Khouzam, El-Gabalawi, Pirwani, & Priest, (2004).

Overview

This literature review will cover several topics relating to both ASD and assessment design. The first topic will be a detailed look at ASD, including a discussion of whether there is a difference between high-functioning autism (HFA) and Asperger's syndrome (AS) under the Diagnostic and Statistical Manual IV (DSM-IV-TR). The next section will deal specifically with the current behavioral indicators of HFA/AS and how these are handled under the Diagnostic and Statistical Manual V (DSM-V).

The Ellis Functional Assessment, a diagnostic tool for identifying the specific problems of individuals with HFA in clinical settings and its relevance for designing an assessment for educators will be discussed. Finally, the information presented in this chapter will be summarized.

Autism

Autism Spectrum Disorders (ASD) are characterized by qualitative impairment of social interaction, communication and behavior (Williams, Thomas, Sidebotham & Emond, 2008). These individuals may show repeated behaviors, focused interests, and resistance to changes in routine. Some have described children with ASD as having "tunnel vision," based on overly focused attention on visual discrimination tasks, evidence of particular difficulties disengaging, and shifting attention from one of two

competing stimuli (Landry & Bryson, 2004). Autism spectrum disorders are lifelong conditions (Fecteau, Mottron, Berthiaume, & Burack, 2003; Harrison, O'Hare, Campbell, Adamson & McNeillage, 2006).

Autism spectrum disorders (ASD) describe a range of conditions classified as neurodevelopmental disorders in the DSM-V, as published in 2013. ASD replaces the previous DSM-IV-TR diagnosis of Pervasive Developmental Disorder which included five subtypes: Autistic Disorder, Asperger Syndrome, Rett's Disorder, Childhood Degenerative Disorder, and Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS). The new DSM-V definition of ASD encompasses PDD-NOS, Autism Disorder, and Asperger's Syndrome (Ghaziuddin, 2010). Although Rett's disorder and Childhood Degenerative Disorder are not included in the DSM-V definition, they are included in much of the literature on ASD as DSM-V is very new. Anyone previously diagnosed with Asperger's syndrome may keep that designation under DSM-V, however new diagnoses will only be labeled as Autism Spectrum Disorder. The term, "low-functioning autism," often refers to the combination of an ASD identification and an IQ below 70 (APA, 2013). Consequently, this identification includes a comorbid diagnosis of intellectual impairment.

It is estimated that 69-70% of children with ASD, identified before 2014, fall into this category (Mayes, Calhoon, Murray, Morrow, Yurich, Cothren et al., 2012). High-functioning autism refers to an identification of ASD with an IQ of 70 or greater (APA, 2013).

Asperger's syndrome, under DSM-IV-TR, was distinguished from ASD by the absence of language delays (APA, 2000). Children with Asperger's syndrome may be

only mildly affected and frequently have good language and cognitive skills. The DSM-IV-TR criteria for Asperger's specified that the individual must have "severe and sustained impairment in social interaction, and the development of restricted, repetitive patterns of behavior, interests and activities that must cause clinically significant impairment in social, occupational or other important areas of functioning" (APA, 2000). It is estimated that about 50% of children with Asperger's syndrome reach adulthood without ever being evaluated, diagnosed, or treated (Khouzam, El-Gabalawi, Pirwani, & Priest, 2004). Even though Asperger's syndrome is not included as a separate diagnosis in DSM-V, individuals may keep this diagnosis, if they wish, and much of the literature discusses Asperger's syndrome even though it is now included under HFA.

Pervasive Developmental Disorder, Not Otherwise Specified (PDD-NOS) is a developmental condition in which some, but not all, features of ASD are identified (APA, 2000). This is considered to be the mildest form of ASD. HFA, LFA, AS and PDD-NOS are all included in the DSM-V definition of Autism Spectrum Disorders. CDD and Rett's are no longer included and are separate diagnoses.

The most secure estimates of ASD prevalence are between 51 and 61.9 per 10,000 persons (Williams et al., 2008). These estimates include all levels of ASD from low-functioning through Asperger's syndrome. There has been an increase in the number of diagnosed cases of ASD in the United States. The incidence of ASD rose seven to eight fold in the twenty year period from 1990 to 2010 (Hertz-Picciotto & Delwiche, 2009). There are several possible explanations for this. The first is the expansion of the definition of "autistic disorder" to "autistic spectrum disorders," which include Pervasive Developmental Disorders Not Otherwise Specified, and Asperger's Syndrome

(Fombonne, 2001). Although this inclusion of milder cases and an increasing earlier age of identification account for some of the increase, they cannot thoroughly explain the magnitude of the rise in ASD (Hertz-Picciotto & Delwiche, 2009). Although there is not, at present, an explanation as to the cause of the increase, the United States government has stated that the number of students identified with ASD rose 528% between 1992 and 2002 (Safran, 2008). In 2014 the United States government reported that the percentages of individuals with HFA and LFA had changed to 54% of individuals diagnosed with ASD having below average IQs while 46% had average or above average IQs (CDC, 2014). This change in percentages supports the continued rise in the number of children diagnosed with milder forms of ASD.

Interestingly, while the sex ratio for low-functioning autism is 2.3 males to 1 female, the sex ratio for high-functioning autism is between 5.3 and 15 males to 1 female (Honda, Shimizu, Imai & Nitto, 2005). The overall ratio of males to females, with all levels of ASD combined, remains near 4:1 as it has for some time (CDC, 2014). It is important to remember that these ratios include only diagnosed cases of ASD and not all actual cases of ASD. Unlike the differences observed between genders, Autism rates in the United States are remarkably similar for all races (Yeargin-Allsopp et al., 2003). Children with ASD are the fastest growing group of special education students in the country even though they continue to be under identified (Morrier & Hess, 2010).

Kanner, the first scientist to define autism, originally described autism in terms of the highlighted attention to detail and the inability to experience wholes without full attention to the constituent parts with the characteristic insistence on sameness and routines found in persons with ASD (Happe & Frith, 2006). At one time individuals with

ASD where hypothesized to show "weak central coherence." Weak central coherence is described as a processing bias towards the local or detail information and a relative failure to extract the gist or "to see the big picture" (Baron-Cohen, Ashwin, Ashwin, Tavassoli, & Chakrabarti, 2009).

Weak coherence can also be found in well-adjusted intelligent adults and may be the part of the autism phenotype that underlies the higher prevalence of ASD in families of engineers, mathematicians, and scientists where attention to detail is important (Baron-Cohen, Bolton, Wheelwright, Scahill, Short, Mead et al., 1998; Happe & Firth, 2006). Fathers and grandfathers of autistic individuals are over-represented in occupations such as engineering, mathematics, and science (Baron-Cohen, 2002). Weak coherence may be a characteristic of only a subset of the ASD population.

This idea of weak central coherence as a core deficit has given way to the suggestion of a processing bias or cognitive style, which can be overcome using tasks with explicit demands for global processing (Happe & Frith, 2006). A different theory called the Hyper-Systemizing Theory has been put forth by Baron-Cohen (Baron-Cohen et al., 2009). This theory argues that the intense attention to detail is directed towards detecting "if p then q" rules and such law-based pattern recognition systems can produce talent in systemizable domains (Baron-Cohen et al., 2009). This attention to detail in ASD, the theory suggests, is itself a consequence of sensory hypersensitivity. Baron-Cohen further argues that intense attention to detail exists in ASD because of evolutionary forces positively selecting brains for strong systemizing, a highly adaptive human ability (Baron-Cohen et al., 2009). One important difference between this theory and the Weak Central Coherence Theory (WCC) is that the WCC theory sees individuals

with ASD as drawn to details for negative reasons while the Hyper-Systemizing Theory sees this quality as being highly purposeful and positive because the attention to detail is occurring with the goal of achieving an ultimate understanding of a system (Baron-Cohen, 2009; Kapp, Gillespie-Lunch, Sherman & Hutman, 2012). As a result, IQ test items, essays, and exam questions designed for people who are neurologically typical, may lead an autistic person to score a zero even if they have a deeper and more extensive knowledge than most people. During these IQ tests, what appears as a slow processing time may be a result of the massively greater quantity of information the autistic individual is processing (Baron-Cohen et al., 2009). At all ability levels, whatever a child with ASD attains on a task will be the result of atypical neurological processes (Dyck, Piek, Hay, Smith & Hallmayer, 2006).

The extreme male brain theory of ASD was first informally proposed by Hans Asperger in 1944. This theory classifies "male brains" as logical, systemizing, and detail focused and "female brains" as empathizing, emotional, and socially focused (Baron-Cohen, 2002). By such a definition, autistic brains are, in fact, extreme "male brains." Baron-Cohen extended this "male brain" theory with his Hyper-Systemizing Theory of ASD. Using the Systemizing Quotient Assessment, which measures ability to integrate information using a rule-based structure, males scored higher than females and individuals with HFA or AS scored higher than males (Baron-Cohen, 2002). The Embedded Figures Task, which measures the ability to find common geometric shapes in a larger design, yields extensive information about field dependence verses field independence (Grant & Davis, 2009). It is used to measure the ability to disembed information from context or surrounding gestalt. On intuitive physics tests, which

measure mechanical reasoning, and on the Embedded Figures Task males score higher than females while individuals with HFA or Asperger's syndrome, regardless of gender, outscore the males (Baron-Cohen, 2002). Thus it seems that Hyper-Systemizing Theory and the Extreme Male Brain Theory agree at their basic premise that autistic minds are drawn to systemizing and detail focus which are more common (but not uniquely) in the male population. Interestingly, the sex ratio of individuals diagnosed with HFA is at least 10 males to every female. Another interesting observation is that on the math section of the Scholastic Aptitude Test, males score 50 points higher than females on average and among those scoring above 700, the male to female ratio is 13:1 (Baron-Cohen, Richles, Bisarya, Gurunathan, & Wheelwright, 2003).

Systemizing works well for understanding phenomena that are ultimately lawful, finite, and predicable. These types of systems appear in computers, musical instruments, tools, weather, biology, mathematics, computer science, legal systems, and collections (Baron-Cohen, 2002). Systemizing is of almost no use when it comes to predicting the moment-by-moment changes in a person's behavior or in understanding another person's thoughts and emotions (Baron-Cohen, 2002). Of the more able individuals on the autism spectrum, many report that they struggle to work out a huge set of rules on how to behave in every social situation as if they were constructing a mental manual based on if-then rules (Baron-Cohen, 2002). When confronted with the unpredictability of the social world in which they live, they often react by trying to impose predictability and sameness in an attempt to control their chaos or by tantrums and an insistence on repetition (Baron-Cohen, 2002; Travis, Sigman & Ruskin, 2001). Such an approach is unlikely to be successful.

Low-Functioning Autism

Under DSM-IV-TR, ASD was divided into two groups: low-functioning and high-functioning. Low-functioning autism is ASD occurring in individuals with IQs of 70 and under. High-functioning autism is ASD occurring in individuals with IQs greater than 70 (APA, 2000). Approximately 70% of individuals with ASD are classified with LFA, making intellectual disability the most common co-occurring disorder with ASD (Matson & Shoemaker, 2009). As IQ goes down the severity of ASD and challenging behaviors goes up, including self-injury (Matson & Shoemaker, 2009; Mayer & Calhoun, 2004). Additionally, boys have a higher incidence of conduct disorders, aggression, Attention Deficit Hyperactive Disorder (ADHD), and Oppositional Defiant Disorder (ODD) than do girls, which may account for their higher rate of identification (Mayes & Calhoun, 2011). Sadly, the severity of a child's disability has been associated with lower peer acceptance, and greater levels of social exclusion, peer bullying, and assault (Little, 2002).

Unfortunately, for this group of individuals the prognosis is not good. A longitudinal study following a group of individuals with LFA found that over 57% had a very poor outcome with at least 50% engaging in moderate or severe degrees of self-injurious behaviors (Billstedt, Gillberg & Gillberg, 2005). Only four of the 120 individuals followed in this study were capable of independent living, 33% were hyperactive, and several had been diagnosed with psychosis (Billstedt et al., 2005). Further, developmental regression occurs in some LFA individuals in addition to having more autism-specific symptoms (Daniels & Mandell, 2013).

On the contrary, there may be some improvement in skills for individuals with LFA. Language skills may improve in low-functioning children, but these skills do not seem to improve to developmentally appropriate levels after the mid-school period (grades 5 or 6) (Sigman & McGovern, 2005). There do not appear to be dramatic individual improvements and changes in intelligence scores past the middle school years even if such changes were seen from early childhood to middle school (Sigman & McGovern, 2005). As a result, a diagnosis of intellectual impairment and ASD is a strong predictor of a poor long-term prognosis (Matson & Shoemaker, 2009).

Children with ASD and an IQ below 70 have a greater incidence of speech and motor delays, comorbid neurological disorders, and neonatal problems in addition to being identified at younger ages than children with higher IQs (Mayer & Calhoun, 2004). Because of the delayed language and cognitive abilities, these children are more likely to be identified before school age than their high-functioning peers (Honda et al., 2005). The male-to-female ratio is at its lowest in LFA where it is approximately 2.3 to 1 leading some to conclude that females with childhood ASD have a more severe condition than males (Honda et al., 2005). It may be that gender-related differences in ASD are less extreme in LFA individuals, making it easier to detect and diagnose ASD in this group of females with ASD (Mayes et al., 2012).

What is evident is that individuals with ASD and an intellectual disability are distinctly different from persons with normal IQ and ASD (Matson & Shoemaker, 2009). This is important because much of the research that is done on ASD is done with participants with LFA and occasionally attempts are made to generalize results to the entire autism spectrum. The problem with this approach is that intellectual disability

provides a serious confound to the results and consequently these results may not be completely attributable to ASD (Grandin, 2001; Matson & Shoemaker, 2009). This is an especially important when researching females with ASD as they are, in a sense, represented at a much higher level on this end of the spectrum than they are at the high-functioning end (McLennan, Lord & Schopler, 1993).

High-Functioning Autism verses Asperger's Syndrome

Ever since the publication of DSM-IV-TR, there has been an ongoing debate as to whether or not there is a difference between Asperger's syndrome and high-functioning autism (Firth, 2004). The main diagnostic difference, in DSM-IV-TR, is that in Asperger's syndrome there is not a delay in language or impaired cognitive ability (APA, 2000). The social impairment of Asperger's is "autistic" in nature as are the focused interests and repetitive behaviors (APA, 2000). According to these criteria, under DSM-IV-TR, a person with Asperger's does not meet the full criteria for a diagnosis of autistic disorder because of the lack of a language delay.

The advocates of keeping Asperger's syndrome as a separate diagnosis base their position on the idea that people with Asperger's syndrome are both quantitatively and qualitatively different from people with HFA. Quantitatively, people with Asperger's syndrome tend to have higher IQs and higher verbal skills (Cederlund, Hagberg, Billstedt, Gillberg, & Gillberg, 2008). Qualitatively, several reports have suggested that persons with Asperger's syndrome show a particular manner of communication, often described as rambling, one-sided or "pedantic" (Ghaziuddin, 2010). They often indulge in monologues, offer excessive details, show speech problems with prosody and intonation, and often seem oblivious as to whether or not the listener is bored or interested in what

they have to say (Ghaziuddin, 2010). The absence of social instinct, the presence of pragmatic speech difficulties, and difficulty understanding the rules of social engagement are a common qualitative feature of Asperger's syndrome (Wing, Gould & Gillberg, 2011).

The hallmark of Asperger's syndrome is a failure in social learning and awareness. Individuals with Asperger's syndrome share many symptoms of ASD that are unrelated to IQ including social isolation, difficulty making friends, insensitive behavior, and lack of social skills (Mayes & Calhoun, 2011). This lack of social skills is often manifested as a basic lack of emotional resonance with other individuals, which is often (and unfortunately) perceived as callousness and coldness (Firth, 2004). As one individual with Asperger's syndrome stated:

> Using precise language was the best way I could see to have a chance of being understood. This wasn't the best solution as it accentuated the difference between how I sounded and how I acted when my internal controls failed. But it was all I had (Schopler, Mesibov & Kunce, 1998, p. 19).

In spite of the many commonalities with HFA, some in the autism community wish to retain the diagnosis of Asperger's syndrome for a number of reasons. One reason is that Asperger's syndrome has a special cachet that hints of superior intelligence and perhaps even genius, a connotative feature not shared with HFA (Firth, 2004). Because of this and the fact that there are successful individuals with Asperger's syndrome that achieve high academic qualifications and scientific achievements, for many this diagnosis is easier to accept than a diagnosis of ASD (Filipek et al., 1999; Firth, 2004). Even so, individuals with Asperger's syndrome carry the same burden of a neuro-developmental

disorder, however high functioning it may be, and are likely to need a measure of support throughout their lives (Firth, 2004).

The overwhelming evidence is that Asperger's syndrome and HFA are not separate disorders. Although Asperger's syndrome is distinguished from autism by a lack of delay in communication, this does not mean that people with Asperger's demonstrate normal communication patterns (Ghaziuddin & Mountain-Kimchi, 2004). Additionally, although diagnosed individuals with Asperger's syndrome tend to have higher IQs than diagnosed individuals with HFA, this is in part because the definition of HFA includes IQs above 70. Further, when group comparisons are done that control for age and IQ, the groups do not show significant differences (Mayes & Calhoun, 2011; Ozonoff, Pennington & Rogers, 1991). Thus, it has become the prevailing view that Asperger's Syndrome is not an essentially different disorder from ASD, but a variant and located at the high functioning end of the autism spectrum (Firth, 2004).

DSM-V

The DSM-V lists four criteria, which must be met for a diagnosis of ASD. The first two of which are behavioral characteristics (or symptoms), persistent deficits in social communication and interaction, and restricted and repetitive patterns of behavior, interests, or activities. To meet the third condition, these symptoms must be present in early childhood, although they may not become fully manifested until later in childhood (APA, 2013). The fourth condition specifies that the symptoms must impair daily function. Sub-criteria are included to identify the behavioral characteristics. These are not defined in terms of objective observable behavior and are less defined than they were

in DSM-IV-TR (Wing et al., 2011). The new DSM-V definition of Autism Spectrum Disorder is:

A. Persistent deficits in social communication and social interaction across contexts, not accounted for by general developmental delays and manifest by all three of the following:

1. Deficits in social-emotional reciprocity,
2. Deficits in nonverbal communicative behaviors,
3. Deficits in developing and maintaining relationships.

B. Restricted, repetitive patterns of behavior, interests, or activities as manifested by at least two of the following:

1. Stereotyped or repetitive speech, motor movements or use of objects,
2. Excessive adherence to routines, ritualized patterns of verbal or nonverbal behavior, or excessive resistance to change,
3. Highly restricted, fixated interests that are abnormal in intensity or focus,
4. Hyper- or hypo-reactivity to sensory input or unusual interest in sensory aspects of environment.

C. Symptoms must be present in the early developmental period (but may not become fully manifest until social demands exceed limited capacities).

D. Symptoms together limit and impair everyday functioning. (APA, 2013)

One of the problems with these new criteria is that individuals with HFA often do not present for the first time until later in childhood or adulthood. Many do not have anyone who knew them in early childhood to give an accurate history (Wing et al., 2011). It remains to be seen how this potential conflict will be resolved under the new diagnostic criteria.

High-Functioning Autism

In a disorder as complex as Autism Spectrum Disorder it may be impossible to search for one primary deficit to explain all of the ways this disorder manifests (Barnhill,

2001). Often children with HFA are not only socially isolated but demonstrate an abnormal range or type of social interaction that cannot be explained by shyness, short attention span, aggression, or lack of experience (Barnhill, 2001). Some of the symptoms include early precocity, a great ability to maintain masses of information, a lack of ability to mix with groups of peers in appropriate ways, indifference to social norms, high intelligence, and an ability to concentrate on the minutia of the task at hand (Freedman, 2007).

Typically, HFA causes the greatest disability in late childhood and adolescence when social relationships are the key to success in most areas of life (Barnhill, 2001). Individuals with HFA perceive the world differently from their neurotypical peers and often do not have the skills to engage in age-expected reciprocal social interactions (Carrington, Templeton & Papinczak, 2003). In high school, these students generally become more aware of their differences: they have a need to fit in but do not know how to do so (Carrington et al., 2001). They are poor judges of character who are socially vulnerable and this vulnerability and naiveté often results in exploitation and bullying (Freedman, 2007; Little, 2002). As a result, these children need help both in understanding social norms and rules and in processing social information (Barnhill, 2001; Bauminger, 2002).

Individuals with HFA show some interesting differences with their peers. Whereas normally developing children prefer to be engaged in social activities rather than in solitary play, children with HFA prefer to spend equal time in social activities and solitary activities (Bauminger, 2002). These students tend to get along quite well with younger children, their teachers, and other adults. Because they may be cooperative at

school and easy to manage, teachers may not be aware that they have any difficulties. (Baron-Cohen, Scott, Allison, Williams, Bolton, Matthews & Brayne, 2009; Church, Alisanski & Amanullah, 2000).

Individuals with HFA tend to have very focused interests generally not shared by most people (Ghaziuddin, 2010). The characteristic that makes these children so unique and fascinating is their peculiar, idiosyncratic areas of "special interest" (Bauer, 1996). In contrast to low-functioning autism, in high-functioning autism the individual interests tend to be in specific intellectual areas (Bauer, 1996). These children will show an obsessive interest in an area such as math, aspects of science, history or geography, wanting to learn everything possible about that subject and tending to dwell on it in conversations and free play (Bauer, 1996). There is value in the fostering of special interests and talents (Grandin, 2001). This might seem self-evident, but stands in contrast to the tendency to see narrow and obsessive interests as maladaptive and limiting (Happe & Frith, 2009). For children with HFA, learning, practice, and performance are all rewarding in their own right and not a means to other incentives (Happe & Frith, 2009). This may be why repetitive practice in a narrow domain is so enormously satisfying for these individuals (Happe & Frith, 2009). Temple Grandin, a noted scientist and autism advocate, stated, "I cannot emphasize enough the importance of developing a talent into an employable skill" (Grandin, 2001, pg. 2).

A majority of children with ASD are characteristically honest, kind, and principled (Ellis, 2013). The incidence of violence or other offenses by people with HFA is very small, at under 2% of the ASD population (Ellis, 2013). In fact, because of the rigid way many of these individuals tend to keep rules and regulations, they might be

more law abiding than the general population (Barnhill, 2007). Given the challenges in reading and interpreting social skills, these individuals' involvement with crime tends to be the result of being set up by more savvy individuals to be accomplices without being aware of malfeasance (Barnhill, 2007).

There are many skills and talents associated with HFA. In a large clinical cohort, almost 30 percent show an outstanding skill either in terms of peak performance on intelligence subtests, or parent-rated savant skills (in, for example, memory, music, or calculation) (Happe & Frith, 2009). An unresolved question is why people with ASD, more than any other group, appear to show such striking isolated talents at such a high rate (Happe & Frith, 2009).

There is a clear association between visual-spatial abilities and ASD. These differences result in high-level skills and expertise in areas such as computing, engineering, and mathematics (Grant & Davis, 2009). In 2001, a study was done comparing the scores on the Autism Quotient Scale of individuals diagnosed with ASD, Cambridge University students, winners of the UK Mathematics Olympiad, and a control population. In this study, mathematicians scored higher than engineers, and physical and computer sciences, who in turn scored higher than persons specializing in medicine and biology (Baron-Cohen, Wheelwright, Skinner, Martin & Clubley, 2001). The results showed that mathematicians scored higher than non-mathematical scientists did and that their scores were not different from the ASD group. This study reinforces an earlier report of an association between math/science skills and autistic conditions. This earlier study of very high-achieving mathematicians, physicists, and computer scientists with

HFA shows that this condition need not be any obstacle to achieving the highest levels in these fields (Baron-Cohen et al., 2001; Grandin, 2001).

Some children with ASD score higher on some measures of intelligence than on others. Raven's Progressive Matrices (RPM) is believed to be a "paradigmatic measure of fluid intelligence" and fluid intelligence tasks are proposed to require coordinated executive function, attentional control, and working memory (Dawson, Soulieres, Gernsbacher & Mottron, 2007). Although RPM test scores do not differ from scores on the Wechsler Intelligence Scale for Children (WISC), another commonly used intelligence test for normally developing children, the autistic children scored as much as 30-70 points higher on the Raven than on the WISC, especially in the area of fluid intelligence (Dawson et al., 2007; Grandin, 2009). The results suggest that HFA involves superior abstract reasoning ability or higher general fluid intelligence as well as frontal executive function, attentional control and working memory (Dawson et al., 2007). This is in direct contrast to the deficit-oriented theories of ASD, which posit weak executive function across the spectrum, and reveals why research results based on individuals with LFA may not be generalized to individuals without cognitive impairment (Grandin, 2001).

Some of the very traits that cause individuals with HFA problems can also be of benefit to them. People with ASD tend to be oblivious to what others think, what is considered the fashionably correct mode of thought, or how others perceive them or their work (Happe & Vital, 2009). Thus, they are more able to think their own thoughts, regardless of what others think (Happe & Vital, 2009). Happe and Vital (2009) posit that this reduced social influence and concern over others' views, as well as time devoted to

talent rather than socializing are obvious contributors to the special flavor, independence, and talents of individuals with ASD. Other contributing factors to success in individuals with HFA include self-motivation, self-teaching, and extreme productivity (Happe & Firth, 2009). Thus, a low dose of autism genes may provide an intellectual advantage while too much of this genetic influence may cause a severe case of ASD (Grandin, 2001).

The prognosis for individuals with HFA may be much better than the prognosis for individuals with LFA. In HFA, 65% are capable of living independently (Cederlund, Hagberg, Billstedt, Gillberg & Gillberg, 2008). This is in part due to the stable overall IQ in the HFA group contrasted with the LFA study group, where there can be a considerable drop in intellectual ability over the years (Cederlund et al., 2008). In fact, because of the lack of confounding intellectual impairment, HFA has been called a model of 'pure' ASD (Firth, 2004).

The factors associated with a good prognosis are high-level social skills and normal IQ (Khouzam, El-Gabalawi, Pirwani, & Priest, 2004). Higher IQ is associated with larger gains in self-care, educational, and communication skills (Levy & Perry, 2011). Furthermore, these individuals are more likely to live independently and attain better educational and employment outcomes (Levy & Perry, 2011).

According to Barnhill (2007) although persons with HFA "looked normal" and "talk normal", they never seemed to "quite fit in." They often describe themselves as "outsiders" who are often excluded socially because they are different (Barnhill, 2007). These experiences are reported to lead to loneliness, anxiety, social withdrawal,

confusion, despair, and depression (Nicpon, Doobay & Assouline, 2010). The major factor affecting social outcome in adulthood is the adequacy of education provisions and access to appropriate education for later employment and social and economic independence (Levy & Perry, 2011). This in why early identification and social skills training are so important for these individuals (Grandin, 2006).

Although high functioning people with HFA may succeed well as adults, such achievements rarely come easily (Barnhill, 2007). These adults will gravitate to a job or profession that relates to their own areas of special interest, sometimes becoming very proficient (Grandin, 2001). They will continue to demonstrate, at least to some extent, subtle differences in social interactions (Bauer, 1996). Successful, high-functioning adults with ASD believe that positive family involvement and support help develop skills necessary to be successful as adults (Grandin, 2001). Efforts to teach them how to talk, interact, play games, and use manners seemed to play a large part in helping them get to where they are today (Hurlbutt & Chalmers, 2002). These adults also made it clear that their families would not give up on them and spurned the professionals who did (Hurlbutt & Chalmers, 2002).

Identifying High-Functioning Autism

It is estimated that about 50% of children with high-functioning autism reach adulthood without ever being evaluated, diagnosed, or treated (Khouzan et al., 2004). This is an unfortunate situation as many children with HFA may miss an opportunity to benefit from intensive early intervention (White, Oswald, Ollendick & Scahill, 2009;

Wilkerson, 2010). There are two possible avenues of identification for children with HFA: through medical professionals and educational evaluations.

Numerous studies have demonstrated that a significant lag exists between the time parents first express concern about their child's development and when the child ultimately receives an ASD diagnosis (Daniels & Mandell, 2013). There is a tendency for some physicians to minimize or dismiss parents' concerns about their child's development. These physicians will generally encourage them to wait for their children to "outgrow it" (Goin-Koechel, Mackintosh & Myers, 2006). A survey of primary care physicians revealed that 44% care for at least 10 children with ASD, yet only 8% routinely screened for this developmental problem (Johnson & Myers, 2007). As a result, parents report visiting four or five clinicians, including doctors and psychologists, on their way to an ASD identification which, on average, occurs at age 4.5 years for ASD in general and 7.5 years for HFA (Goin-Koechel et al., 2006). Whatever the reasons for the delay, this process contributes to parental distress in coping with the disorder and postpones eligibility for intervention services, which may affect long-term outcomes for these children (Goin-Koechel et al., 2006).

When children with ASD reach school age, most with LFA have been identified because of both cognitive impairment and more severe symptomology (Dawson et al., 2007). Identification of students with HFA is often more problematic for a variety of reasons including a diverse array of involved personnel and the assessments used by school systems (Bauer, 1996). Previous research indicates that a wide range of school personnel rely on the Childhood Autism Rating Scale (CARS) to determine ASD eligibility which may result in school assessment teams missing some of the more subtle

signs associated with ASD, that can be picked up by use of the Autism Diagnostic Observation Schedule (ADOS) with its associated Autism Diagnostic Interview-Revised (ADI-R) or a parent interview (Morrier, & Hess, 2010). This is because the CARS was designed and normed using a population of young children, a majority of whom had LFA (Morrier, & Hess, 2010).

Students with HFA are usually seen in mainstream educational settings, although often undiagnosed or misdiagnosed (Bauer, 1996). These children often escape the notice of teachers, because they present as pleasant and nice, and just seem a little bit odd (Bauer, 1996). The vast majority of undiagnosed children who were identified at school were not identified as having ASD but were instead classified as having learning difficulties rather than social or communication difficulties (Russell et al., 2010).

In a recent total population study of all of the children in a geographic area, it was discovered that more than half the children with autistic impairment at the same levels as those with an ASD identification were not identified (Russell et al., 2010). In this study, the ratio of undiagnosed boys to girls was 2:1; much lower than the ratio in the diagnosed HFA population (Russell et al., 2010). In a different total population study, the clinical characteristics of the undiagnosed group of children with ASD's differed from those children in the diagnosed group, they had higher cognitive abilities and a lower male predominance (Kim et al., 2011). In fact, in this study, 12% of the undiagnosed student population with ASD had IQs over 120. These twice-exceptional students may be in need of services to meet their full educational potential.

Since ASD has a spectrum of symptom severity, many less impaired children who might meet criteria for that identification receive no identification at all and are viewed as "unusual" or "just different," or are misdiagnosed with conditions such as ADHD, emotional disturbance, etc. (Bauer, 1996). The most common misdiagnosis for HFA is ADHD (Farrugia & Hudson, 2006). Unlike most children with ADHD who have difficulty sustaining their focus on anything, children with ASD have the ability to hyper-focus on activities of interest to them (Mayes et al., 2012). Diagnosis is complicated by the overlap in symptomology of ASD with ADHD, depression, and anxiety disorders, which can lead to diagnostic uncertainty (Hartly & Sikora, 2009). Some ASD symptoms such as disorganization, oddness of speech, and extreme anxiety in response to stressful social interactions could even be misdiagnosed as psychosis (Khouzan et al., 2004).

Accurate identification increases the chance that students will receive appropriate services and have maximum opportunity to realize their potential (Neihart, 2000). There potentially remain tens of thousands of public school students yet to be identified with ASD according to the most recent figures from the United States Government (Safran, 2008). Teachers and other educators usually provide the first access to educational services. Children with HFA may go unnoticed until they are of school age, when teachers notice difficulties with peer interactions (Johnson & Myers, 2007). It is vitally important that teachers and other educators are better able to identify these children in need of services.

Identifying Older Students Verses Identifying Younger Students

There are substantial developmental changes in autistic symptoms in children with autism spectrum disorders (Fecteau, Mottron, Berthiaume & Burack, 2003). As a result, older children and adolescents may not demonstrate the same behaviors seen in younger children. The most robust changes in behavior occur for those children with ASD that do not also suffer from mental impairment, in other words, those children with HFA (Fecteau et al., 2003). Although children with HFA show the most improvement in symptoms with age, they continue to meet the criteria for the diagnosis in adolescence and adulthood (Seltzer et al., 2004). This reflects the lifelong nature of ASD, even in individuals with HFA.

The extent of improvement varies according to the domain of behavior being considered. The proportion of individuals who have maladaptive behaviors decreases significantly with age (Shattuck et al., 2007). The behaviors that show improvement include: socially offensive behaviors, uncooperative behaviors, destruction of property, injury to others, injury to self, inattentive behavior, and unusual or repetitive habits (Shattuck et al., 2007). It is interesting that repetitive behaviors, which in early childhood tend to be a very prevalent feature, tend to be among the least prevalent in adolescents (Shattuck et al., 2007). As these are behaviors many associate with ASD, it would be possible to miss identifying an older child who displayed fewer of these symptoms.

The available studies indicate that the core deficit in communication may ameliorate to some degree by adolescence (Seltzer et al., 2004). There may also be modest improvements in social functioning for individuals with HFA by adolescence

(Seltzer et al., 2004). Nevertheless, the majority of individuals with ASD remain impaired in both communication and social functioning (Seltzer et al., 2004).

There is also a reduction in sensory issues, described as particular interests in the sight, feel, sound, taste or smell of things or people, with age (Chowhury et al., 2010). There is also a considerable proportion of the population of individuals with HFA that have never had these issues (Chowhury et al., 2010).

The two characteristics most associated with improvements in communication and social functioning are IQ and early language status (Fecteau et al., 2003; Seltzer et al., 2004; Shattuck et al., 2007, Chowhury et al, 2010). These are the characteristics among under-identified groups of students. It is not surprising then that assessments designed and normed on younger children fail to identify this group of older children.

There are autistic symptoms that do not improve with age. Two of these symptoms are limited range of focus and circumscribed interests (Chowhury et al., 2010). In fact, research suggests that circumscribed interests are more common in individuals with higher IQs (Chowhury et al., 2010). These restricted interests may be considered as secondary to the language and social deficits and possibly as either a consequence of them or a compensation for them (Fecteau et al., 2003). Another symptom, which showed no improvement with age was nonverbal communication impairments (Shattuck et al., 2007). In fact at all stages of life, the greatest impairments for individuals with ASD are nonverbal communication and social reciprocity, especially for people with HFA (Shattuck et al., 2007).

These developmental changes may help to explain why current assessments, largely normed on younger populations, do not do as well identifying older children, especially those with HFA. Older children with HFA continue to meet the diagnostic criteria for ASD, yet are under-identified. Because they do not show the same symptomatology as younger children, they may appear to adults as having problems other than ASD. There currently are no screening instruments or assessments that have been normed specifically on this group. There is a clear need for a screening instrument that fills this void.

Identifying Girls

Due to the rarity of diagnosed females with ASD, several studies have lacked the statistical power to detect anything less than large effects based on gender and studies of higher-functioning and older individuals have been particularly afflicted by this power problem (Mandy, Chilvers, Chowdhury, Satler, Seigal & Skuse, 2012). Currently more males are diagnosed with ASDs than females and the ratios are at the most extreme in higher functioning individuals. For LFA, the overall ratio of diagnosed male to female individuals is 2.5:1, but for people with HFA, the male to female ratio is much higher ranging from 6:1 to as high as 15:1 (Honda et al., 2005; Johnston & Myers, 2007). A further complication is that since the diagnostic criteria used for ASD are arguably derived from male cases, it is possible that that the number of female cases is underestimated (Mandy et al., 2012). Thus, we have a circular situation. Since the samples contain more males than females, the assessments are based on male characteristics which leaves many females with ASD unidentified.

Girls with ASD may not have the same behavioral phenotype as boys with ASD, making identification difficult (Mandy, Chilvers, Chowdhury, Satler, Seigal & Skuse, 2012). One hypothesis is that girls' social and communication deficits may go undiagnosed because of their generally less aggressive presentation (Assouline, Nicpon, & Doobay, 2009). As a result, girls with higher-functioning autism are often diagnosed at an older age if at all (Goin-Kochel et al., 2006).

There are many reasons why girls are underdiagnosed in addition to the fact that the assessments are tested and normed on male populations. Female children may be more likely considered for a diagnosis of depression rather than ASD as there is a same sex ratio for boys and girls having depression; however, ASD is viewed to occur more frequently in boys (Cooper & Hanstock, 2009). This can interfere with the early identification of ASD and result in missed opportunities that early intervention can provide.

Over the years, it has become evident to those in the field that many girls and women with ASD have a clinical picture that differs in some ways from those in boys (Wing et al., 2011). As a consequence, there appears to be many girls who meet the diagnostic criteria of ASD but who either remain undiagnosed or have been given an alternative diagnosis (Wing et al., 2011). The lack of correct identification of ASD is often the result of parents and/or school staff being unaware of the main features of the identification; for example, attributing symptoms such as difficulties with social skills to other reasons such as shyness (Cooper & Hanstock, 2009). Female children may be harder to diagnose because they tend to camouflage their social skill difficulties by watching and then imitating other socially competent peers (Cooper & Hanstock, 2009;

Filipek, Accardo, Baranek, Cook, Dawson, Gordon et al., 1999). Some of the telltale signs among females with good camouflage include speaking and/or writing too much or difficulties with switching attention (Lai et al., 2011). In spite of their camouflaged exterior, females show greater difficulties than males with anxiety, social withdrawal, social problems, thought problems, and attention problems (Mandy et al., 2010). Female children with ASD can be easily mistaken as being depressed, because they have a normal IQ and good language skills. Depression is the most common misdiagnosis for females with ASD (Cooper & Hanstock, 2009).

The identification of girls with ADHD is also hampered by parental and teacher bias and confusion (Kopp et al., 2010). The restlessness of these girls and their less obvious, but continuous, movements presents differently and are more subtle than the repeated behaviors in boys; additionally, 80% of the ASD females had coexisting ADHD (Kopp et al., 2010). Therefore, whenever girls are referred for social or attention issues, ASD needs to be considered as a possible identification (Kopp et al., 2010).

Clinicians evaluating girls with a complex developmental profile may erroneously exclude a classification of ASD based on the presence of other intellectual, developmental, and medical conditions (Giarelli et al., 2010). Another possible explanation for the sex difference in the presence of an ASD classification is "interpreting bias," which is the difference between observed and expected behaviors (Giarelli et al., 2010). Even when females meet the criteria for autistic disorder, the clinical "gestalt" may not be that which is commonly associated with ASD (Kopp & Gillberg, 1992). As teenagers and adults, girls sometimes demonstrate other presenting problems, such as anorexia nervosa, paranoid disorder or milder paranoid problems and

obsessive-compulsive disorders of various kinds, but on closer examination, and after having presented a detailed developmental history, appear to have almost the same kind of social impairment as seen in ASD (Kopp & Gillberg, 1992). The symptoms for these young women are milder and have not surfaced to the extent that they have for lower-functioning autistic women earlier in life.

Some individuals diagnosed with HFA do not conform to the stereotypical set of clinical symptoms and this is particularly evident in female patients (Strum, Fernell, & Gilberg, 2004). Taken as a whole the findings above support the notion that there are subtle but potentially important differences between the male and female ASD phenotype. These differences need to be accounted for in both identification and diagnostic assessments if these girls to be identified.

Identifying Gifted Students

Another group of under-identified students are twice-exceptional gifted students with HFA. This is often because it may appear that a child's unusual development is a result of giftedness, not ASD (Henderson, 2001; Neihart, 2000). Neihart pointed out some key differences that can be used to make this critical distinction:

1. Twice-exceptional children are typically pedantic whereas normal gifted children are not;
2. These children run on and on when answering questions because they are not sure of the purpose of the question;
3. Twice-exceptional students have routines that are more rigid and have great difficulty with the lockstep scheduling and the routine of traditional classrooms;
4. The normal eccentric person is aware that others regard his behaviors as odd while the individual with HFA is not aware because they have no sense that they have done anything out of the ordinary;

5. Children with HFA will assume others understand their references and will not be aware that others may find their memory remarkable in any way;
6. These individuals are prone to distraction, but it is distraction that comes from within;
7. These children will also interrupt private conversations and enter or leave abruptly without concern for the wishes of others;
8. These twice-exceptional students have a remarkable lack of insight and awareness regarding the feelings, needs and interests of others (Neihart, 2000, p.5).

Parents and teachers of these students often agree that something is wrong but just not know what it is (Neihart, 2000). These feelings are exacerbated when the discrepancy between their intellectual and developmental abilities baffles parents, teachers and peers (Nicpon, Doobay, & Assouline, 2010). Just like with other high-functioning youth with ASD, it is during adolescence that they become more aware of their social ineptitudes and consequently they experience loneliness, anxiety, social withdrawal, confusion and depression (Nicpon et al., 2010). The more gifted and intelligent the child is, the more he is aware of his "differentness" and of the social problems that accompany it; the more aware he is, the more depression he experiences (Gallagher & Gallagher, 2002). Unlike children with ASD who often receive special assistance in schools, these gifted students may be left to manage the best they can (Neihart, 2000). They experience difficulty navigating their social world and often experience rejection and are at increased risk for bullying and exploitation by their peers (Nicpon et al., 2010). Further, without assistance, relationships with teachers and peers can be extremely difficult and over time, these students may become depressed and isolated (Grandin, 2007; Neihart, 2000).

Accurate identification is necessary to obtain appropriate assistance. It can lead to social skills training and increases the chance that students will have the maximum opportunity to realize their potential (Neihart, 2000; Nicpon, Assouline, & Stinson, 2012). Although both disabilities and giftedness need to be addressed for the student to thrive, it may be most helpful to view these students as gifted first and as possessing a learning disability second in order to ensure that they remain challenged and engaged with school (Nicpon, Allmon, Sieck & Stinson, 2011). Ironically, the time that these students spend in gifted education settings serves as a powerful intervention (Gallagher & Gallagher, 2002). It is however, not sufficient to provide just academic challenge to twice-exceptional children, for that only addresses part of the problem (Holmes & Sutherland, 2011; Nicpon et al., 2011).

Individuals with ASD can rise to eminent positions and perform with such outstanding success that some may conclude that only such people are capable of certain achievements (Neihart, 2000). This may be especially true in the field of mathematics (Fitzgerald, 2002). These twice-exceptional students can have high levels of coexisting creativity and appear to enjoy a challenge in their specific areas of interest. These interests should be fostered to help ensure long-term success (Nicpon et al., 2011; Schultz, 2012). These children demonstrate very superior verbal and nonverbal reasoning skills, and high fluid intelligence (Hayashi et al., 2008). This combination can lead to high-level reasoning and novel problem-solving abilities (Hayashi et al., 2008). As adults, these children can become well-adapted and even very successful (Neihart, 2000). Even so, as ASD is a lifetime neurodevelopmental disorder, many do tend to

remain socially isolated, egocentric, and idiosyncratic (Fecteau et al., 2003; Harrison et al., 2006).

Child Study Team

School child study teams determine if students are eligible to receive special education services. When making a determination of eligibility for services under the category of ASD, these committees utilize the educational definition of ASD contained in IDEA 2004 (Nicpon et al., 2011).

The Individuals with Disabilities Education Act (IDEA 2004) is a law ensuring services to children with disabilities. IDEA 2004 governs how states and public schools provide special education and related services to youth with disabilities. IDEA 2004 states the educational definition of ASD as a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, which may manifest itself in an imperfect ability to listen, think, speak, read, write, spell, or to do mathematical calculations (Nicpon et al., 2011). The IDEA 2004 definition of ASD requires language and communication impairment that have a negative effect on educational outcomes (Nicpon et al., 2011). This is not the same as the DSM-V definition and applies only to eligibility to receive special education services.

The process for evaluation for educational services under this definition is detailed in federal and state regulations. The process in Virginia is discussed below; however, these procedures are similar across the United States.

The Virginia Department of Education lists the five steps involved in the special education process as follows:

> 1. Identification and referral. When a child is suspected of having a disability, a referral, which is a written or oral request for an evaluation, is given to the school's child study team.
>
> 2. Evaluation. The school's child study team then evaluates the child to determine whether the child has a disability as well as the nature and extent of the special education and related services that that child needs.
>
> 3. Determination of eligibility. Based on the results of the evaluation, the team decides if the child is eligible to receive special education and related services. To be found eligible, the team must decide that the child has a disability and as a result needs special education and related services.
>
> 4. Development of an individualized education program (IEP) and determination of services. If the child is eligible to receive special education and related services, the team then develops and implements an appropriate IEP to meet the needs of the child. This team also decides the particular services the child will receive. The IEP must be reviewed and revised at least annually.
>
> 5. Reevaluation. At least every three years, the team must reevaluate the child to determine whether the child continues to need special education and related services (VDOE, 2010, p. 8).

In addition to these five steps that are mandated by state and federal law, there are additional requirements that the child study team must follow (VDOE, 2001). The child study team must meet within ten days of receiving the referral (VDOE, 2001). The team members will decide whether there is enough information to make a determination of eligibility (VDOE, 2001). If the team finds that more information is needed, it must identify the additional information and seek parental consent to evaluate (VDOE, 2001). If, however, the child study team decides that there is enough information, then the team's review will be considered an evaluation (VDOE, 2001). All information is provided to the parent in their native language as well as information as to their rights and the appeal process under federal and state law (VDOE, 2001). The child study team consists of the following personnel; the child's parent, at least one regular education

teacher, at least one special education teacher, an administrator, the child (if appropriate), school social worker or psychologist, and other professionals as appropriate (VDOE, 2010).

Previous research indicates that the wide range of school personnel with different backgrounds and the different assessments used by school systems play a large role in determining who qualifies (Morrier & Hess, 2010). The result is inconsistency from system to system as to who qualifies for the educational classification of ASD under IDEA 2004. Consequently, there continues to be a need for developing brief, precise, and validated screening tools for identifying more subtle autistic symptoms in both preschool and school age children (Wilkerson, 2010).

Current Assessments for High-Functioning Autism

There is no universal agreement on diagnostic characteristics of HFA, particularly relative to female and gifted students (Ehlers, Gillberg & Wing, 1999). As such, there are some differences in the assessments and screening protocols. Youngsters on the higher functioning end of the spectrum, whose symptoms often are masked during early childhood, can be identified for special education services at an older age under the category of ASD. Evidence suggests that the educational (IDEA) definition of ASD is operationally acceptable to both the legal and the advocacy communities (Safran, 2008).

One reason for discrepancies in finding children qualified for autism eligibility may come from differing criteria used by the medical and educational communities. This confusion often arises because a child can be found eligible under one set of criteria, but not under the other (Morrier & Hess, 2010). Where the IDEA definition of ASD used to

get an educational classification requires "language and communication impairment that have a negative effect on educational outcomes," the medical profession uses the DSM-V definition for diagnosis. The DSM-V requires meeting all four parts of the definition. The first part of the definition has three requirements, the second part two requirements and the third part requires that the problems have persisted since early childhood (even if they did not manifest until later). The fourth part stipulates that the symptoms must impair daily function. It is not surprising then that there are differences and inconsistencies between the assessments as by design they are measuring different behaviors in order to qualify under different definitions.

The label of "autism" serves many purposes. It helps professionals and families communicate, allows children to access specialized intervention approaches, provides a basis from which treatment and prevention research can occur, leads to appropriate intervention and program planning, and provides a framework for gathering information on outcome, causes, and associated problems (Ruble & Akshoomoff, 2010).

Currently, there are no screening instruments for older children with HFA. In fact, there is only one screening instrument in current use. The Modified Checklist for Autism in Toddlers (MCHAT) is a screening device that is designed for children up to 30 months of age. Although it is in wide use for screening young children, it does not effectively screen older children as it was designed and normed on younger children with LFA (Firth, 2004). There are full assessments that require a trained psychologist to administer. Unfortunately, these assessments are given to children only after a child study team determines a need. Research indicates that school personnel with different backgrounds rely on the Childhood Autism Rating Scale (CARS) to determine an ASD

eligibility, which may result in school assessment teams missing some of the more subtle signs associated with HFA that can be picked up by use of the Autism Diagnostic Observation Schedule (ADOS) or a parent interview (Morrier & Hess, 2010). Further compounding the issue for twice-exceptional students, it is rare for professionals to be trained in the identification of HFA and in the identification of cognitive and/or academic giftedness (Nicpon et al., 2011). Autism Diagnostic Interview-Revised (ADI-R), a companion instrument, is a structured interview conducted with the parents that is designed to accompany the ADOS. Both of these require extensive training to administer and may only be administered by a licensed psychologist specifically trained in the use of this form. Even so, modifications of the ADOS for older children and adults are needed to present more age-appropriate tasks (Gotham, Risi, Pickles, & Lord, 2007).

Studies suggest that clinical populations for which the ADOS is used may be substantially different from the research samples on which it was normed. This diagnostic measure is likely to have difficulty with specificity and sensitivity for children with ASD who do not present with classic features of ASD, such as gifted students, females, and older students with HFA (Wilkinson, 2012). Further research on the ADOS is needed with a broader range of children typically seen in clinical and school settings (Wilkinson, 2012). Additionally, since the ADOS is based on one observation, it does not meet the DSM-V requirement of symptoms being present in early childhood. There is a need for a DSM-V compatible assessment for HFA that is sensitive to older children, gifted children and female children. This need is further supported by the increasing percentages of children with milder forms of ASD that are being screened for identification (CDC, 2014).

Ellis Functional Assessment

The purpose of the Ellis Functional Assessment (EFA) is to determine an individual's functional level in different areas of qualitative impairment associated with HFA (Deeley, Harrington, & Ellis, 2011). The overarching goal is to give practitioners a way to determine current functioning so appropriate assistance in deficient areas can be provided (Deeley et al., 2011). This goal is consistent with the educational classification of ASD as it focuses on areas that would benefit from educational interventions for the deficits in functional abilities associated with ASD. The EFA assessment already meets one of the requirements of DSM-V, the presence of symptoms in early childhood. This feature is unique to this assessment.

The EFA is a long assessment. It contains 272 questions each of which requires two answers, one for present behavior and one for early childhood behavior. The assessment is completed by the parent/guardian. The questions are all Likert response scale questions with responses varying from 0 to 10. There are 23 sections on the EFA assessment including:

1. Problems with Social Interaction;
2. Difficulties with Nonverbal Interaction;
3. Problems Sharing Enjoyment, Interests, or Achievements with Others;
4. Difficulties Interacting with Friends or Others;
5. Unusual, Restricted, and Repetitive Patterns of Behavior, Interests and Activities;
6. A Lack of Social or Emotional Back and Forth Interaction;
7. Academic Concerns;
8. Qualitative Impairments in Communication;
9. Major Changes in Environment that Cause Problems;
10. Possible Motor Problems;
11. Environmental Confusion;

12. Visual Sensitivity;
13. Olfactory Sensitivity;
14. Auditory Processing;
15. Tactile Defensiveness;
16. Movement/Vestibular;
17. Taste Concerns;
18. Perceptual/Perceptual Motor;
19. Personal Management/Self Control;
20. Difficulty Understanding the Specific Behaviors Required for Specific Concepts;
21. Health or Physical Concerns;
22. Negative Reactions to Discipline;
23. Previous Diagnoses.

A two-item sample from the EFA is shown in Figure 1 below.

Rating---Please rate from 0 to 10 on the characteristics listed below.
0 = No Problems/Difficulty, 5 = Moderate Problems/Difficulty, 10 = Severe Problems

Difficulties with Nonverbal Interaction	In the past	Currently
Not accepting cuddling, hugging, touching unless self-initiated		
Problems with eye to eye contact		

Figure 1. Sample Items from the Ellis Functional Assessment

This assessment was developed by C. R. Ellis, a clinical psychologist specializing in autism spectrum disorders. The EFA is designed to be completed by the parents or guardians of a child. It is based on research and many years of clinical practice and has been utilized successfully for the past 12 years (Deeley et al., 2011). The EFA is the result of extensive research from wide variety of sources including recent publications, school system evaluations and many others (C.R. Ellis, personal communication January 14, 2014).

This assessment has demonstrated internal validity and reliability (Deeley et al., 2011). Internal validity was established on two levels. First, content validity was established by reviewing the items to establish that they are measuring functionality in areas problematic to people with autism spectrum disorders (Deeley et al., 2011). Secondly, internal validity was established by the strong correlations (greater than .600) between different sections of the assessment as shown in table 1 below:

Table 1

Correlations between subscales in the Ellis Functional Assessment

Strong Correlations within the Ellis Functional Assessment	
Subsection	Correlating Subsection
Problems with Social Interaction	Difficulties Interacting with Friends and Others
Problems with Social Interaction	Lack of Social or Emotional Back-and-Forth Interaction
Problems with Non-Verbal Interaction	Difficulties Interacting with Friends and Others
Lack of Social or Emotional Back-and-Forth Interaction	Difficulties Interacting with Friends and Others
Problems with Personal Management and Self Control	Difficulties Interacting with Friends and Others
Problems with Personal Management and Self Control	Negative Reactions to Discipline
Lack of Social or Emotional Back-and-Forth Interaction	Academic Concerns
Unusual, Restricted, and Repetitive Patterns of Behavior, Interests and Activities	Visual Sensitivity
Lack of Social or Emotional Back-and-Forth Interaction	Difficulty Understanding the Specific Behaviors Required for Certain Concepts

(Deeley et al., 2011)

Reliability was established by the very strong correlations (greater than .800) between the past and current scores on the assessment (Deeley et al., 2011). The reliability will be retested on the full data set and sample group as part of the preliminary analyses for this dissertation.

Purpose Statement

The purpose of this study is to develop a short pre-screening assessment to assist school staff is assessing when a student should be referred to the school's child study team for a determination of eligibility for special education services under the category of ASD. The assessment will involve input from both a parent/guardian and an educational professional familiar with the student. The assessment will be easy to score and not require specialized training for implementation.

Research Questions

The assessment will be developed by analyzing a medium sample (N = 538) of responses from individuals diagnosed with HFA who completed the Ellis Functional Assessment.

Research Question 1:

What are the latent factors assessed in the Ellis Functional Assessment for high-functioning autism?

a) Do these factors change when considering populations aged 8 – 12 years or aged 13 - 18 years?

b) Do these factors change when considering gifted verses non-gifted populations?

c) Do these factors change when considering only male or female sub-populations?

Research Question 2:

Given the factors found in research question one, which items from the Ellis Functional Assessment align with which identified Latent Factors?

a) Do these alignments change when considering populations aged 8 – 12 years or aged 13-18 years?

b) Do these alignments change when considering gifted versus non-gifted populations?

c) Do these alignments change when considering only male or female sub-populations?

Research Question 3:

To what degree can a valid 15 to 25 item pre-screening questionnaire for high-functioning autism be developed using these items and factors?

a) Can a single valid assessment be developed or is it necessary to develop multiple pre-screening instruments based on age, gender, or gifted status?

Summary

ASD should be considered a stable lifelong impairment in which symptoms change with development, and not as an impairment defined by fixed, age-independent symptoms (Fecteau et al., 2003; Harrison et al., 2006). Current screenings for ASD may not identify children with milder variants of the disorder especially those without cognitive impairment or obvious language delay (Kim et al., 2011; Russell et al., 2010).

These children's difficulties often go undiagnosed for years, causing them to experience increasing difficulty meeting the demands of elementary and secondary education without needed supports (Filipek et al., 1999). As such, the need exists for proper identification and support services for these individuals.

Without needed interventions, these individuals remain socially vulnerable. This social vulnerability and naiveté often results in exploitation (Freedman, 2011). Students with HFA can benefit by learning compensatory social strategies, just as students with learning disabilities learn strategies to compensate for their disability (Neihart, 2000). They cannot receive these interventions if they are not first identified.

Students on the higher functioning end of the spectrum, whose symptoms often are masked during early childhood, can still be identified for special education services at an older age under the category of ASD (Safran, 2008). These children would likely benefit greatly from improved screening efforts and the increased opportunity for services that would result (Barnhill, 2007). This improved screening needs to target the symptoms of commonly under-diagnosed individuals with high-functioning autism including girls, older children, adolescents, and young adults (Filipek et al., 1999; Kim et al., 2011).

Intelligence Quotient (IQ) is more significantly related to autistic symptoms than any other independent variable (Mayes & Calhoun, 2011). As IQ increases, autistic symptoms decrease; furthermore, because of milder symptoms, children with higher IQs are likely to be identified as having ASD at a later age (if at all) than children with lower IQs (Mayes & Calhoun, 2004). Twice-exceptional children tend to have superior to very

superior verbal and nonverbal reasoning skills while their social and communication skills are comparable with other children diagnosed with ASD (Nicpon et al., 2011). Although "misdiagnosis" is a possibility with gifted children, the greater risk is "missed" diagnosis, which precludes the opportunity for appropriate intervention (Assouline et al., 2009). It is imperative that gifted children with HFA be identified so that they can receive appropriate services (Neihart, 2000).

Measuring adaptive functioning to screen for ASD improves screening for all students, especially gifted students who have suspected HFA because it focuses on skill areas normally problematic for students with ASD (Assouline et al., 2009). Because HFA is often recognized when the child is at school, there is a practical need for assessments that can be used in a school environment (Freedman, 2007). Parent and teacher screening tools are especially ideal instruments for identifying children who are in need of a more comprehensive evaluation because they yield important information from the individuals who know the child the best (Wilkerson, 2010). Clearly, there is a need for a screening assessment that measures these areas of adaptive functioning that can be utilized in a school environment. Ideally, this assessment would receive input from both teachers and parents.

The EFA contains 272 items with two sub-items each (one for current behavior and one for early childhood behavior). This rich reservoir of items will be analyzed using exploratory factor analysis to identify both the underlying latent variables and the items associated with each. From this process, it will be possible to identify which items most closely contribute to which factors. These items will then be evaluated for inclusion in the shortened version of the assessment based on their relevance to a school environment

and their alignment with DSM-V. Because the assessment contains both data on behavior from early childhood and current behavior, this assessment is uniquely able to provide a basis for the new shortened assessment under the third DSM-V criterion requiring that symptoms be present at a young age.

The population of individuals who completed this assessment represent a large number (538) of clients from a mid-Atlantic practice specializing in autism spectrum disorders. Because of the size of the population, it will be possible to run an exploratory factor analysis on sub-populations based on age and gender to see if the same factors and loadings occur in each.

The advantages of this new pre-screening assessment will be three-fold. First, this assessment will contain no more than 25 items and will be able to be completed in approximately 10 minutes by both parent and teacher. The parent input should provide information on behavior in early childhood, a requirement under DSM-V. Scoring will be simple and make referral to the school's child study team a simple data- based decision.

Secondly, the entire population in the data set for this process have a confirmed diagnoses of HFA. As there are functional differences between lower-functioning children with ASD and higher-functioning children with HFA, this means that the sample reflects the group most in need of identification. In addition, since all of the items on the EFA deal with functionality in daily life, the selected items are likely to be easily observable by parents and teachers. The hope is that this pre-screening assessment will lead to identifying more young people to the school's child study team for a possible classification of ASD.

Chapter 3

Methodology

Introduction

The under-identification of high-functioning autism (HFA) is a problem that may cause difficulties for high functioning young people with autism spectrum disorders in both educational and social settings (Fombonne, 2001). Many times HFA students are mislabeled and misdiagnosed, generally with ADHD, OCD, depression, and anxiety (Bauer, 1996). As a result, they do not receive the educational support services they need to maximize their educational success. In this chapter, the methodology used to develop a pre-assessment to assist in the identification of high-functioning autism is detailed.

Purpose Statement

The purpose of this study is to develop a short (15 to 25 question) pre-screening questionnaire to assist school staff is assessing when a student should be referred to the school's child study team for a determination of eligibility for special education services under the category of Autism. The questionnaire will involve input from both a parent and an educational professional familiar with the student.

Designing a Short Form Assessment

There are many pitfalls to designing a short form version of an established assessment. The first common pitfall is to develop a short form of a longer assessment without establishing the validity for the longer assessment first (Smith, McCarthy, & Anderson, 2000). This pitfall will be avoided in the current study by developing a short form assessment of EFA, the long form of which already has demonstrated internal

validity and reliability. This internal reliability will be evaluated for each subcategory on the EFA as an additional check of its reliability.

The second great pitfall is to assume that since the new measure is shorter, less validity evidence is required. It is harder to have reliability and full content coverage, and hence validity with fewer items (Smith et al., 2000). As a result, it is important to show that the new assessment preserves the content coverage of the original measure and to show that the content is measured reliably (Smith et al., 2000). It is also important to show that the shorter assessment reproduces the factor structure of the original form and if some sub-factors are omitted, that the short form preserves the overall factors and content domains represented by those sub-factors (Rattray & Jones, 2007; Smith et al., 2000).

The goal of the short form designed in this study is to conduct screening to identify individuals who should be referred for more comprehensive screening. This goal values sensitivity over specificity even if that leads to some false positives since the goal is to refer the most students with undiagnosed high-functioning autism to the child study team. By this approach, the maximum number of at risk students will be referred for further assessment and the false positives will be identified at that point by the school psychologist (Smith et al., 2000). This short form should represent a savings in time as it will utilize far fewer questions and will be designed to be completed by a parent or a teacher in ten minutes or less. The parent portion of the assessment will include both current and early childhood behavior while the teacher portion will be focused on current behavior in the school environment.

Exploratory Factor Analysis

In order to ensure that all of the latent factors covered in the Ellis Functional Assessment are covered in the shortened form it is first necessary to identify all of the latent factors in the original assessment. This will involve utilizing exploratory factor analysis to specify construct dimensions within the original assessment. Factor analysis produces a factor structure that reflects the relationship between the latent and measured variables (Bernstein, Stein, Newcomb, Walker, Pogge, Ahluvalia et al., 2003).

Factor analysis works by clustering highly correlated items together in weighted linear combinations. The coefficients of the items in this linear combination are called loadings (Thompson, 2010). The higher the loading values the more the items contribute to the factor in question. Each factor is then assigned an eigenvalue, which is an index of how much of the assessment information is contained in that factor (Thompson, 2010).

Another approach to determining the number of significant factors is to look at the Scree plot. The Scree test for significant factors determines the number of significant factors to be the number of points lying to the left of the point of inflection on the graph (Thompson, 2010). A point of inflection is where the concavity of the graph changes and can be thought of as looking for the "elbow" in the graph. The factors to the left of the point of inflection contribute the most information while the factors to the left of the point of inflection contribute increasingly less information, most of which is contained in the prior factors (Thompson, 2010). Fortunately, the Scree test and the Eigenvalue greater than one rule generally agree on the number of latent factors within the data set and any minor differences are easily resolved (Thompson, 2010).

Additionally, there are two types of rotation to consider when using factor analysis, orthogonal and oblique. Using orthogonal rotation requires that the latent factors are uncorrelated (Thompson, 2010). This is a situation that may occur in some natural phenomenon but rarely occurs in assessment of human behavior as the underlying components of behavior tend to be highly correlated (Osborne, Costello & Kellow, 2008). Highly correlated variables, such as those found in the social sciences use oblique rotations to allow for their correlations in producing the latent factors contained in the data (Osborne et al., 2008). Thus, for this application, the preferred rotation would be oblique specifically, Varimax Rotation (Osborne et al., 2008).

Once the number of factors has been identified, that number of factors will then be extracted. The items with the highest loadings (those that contribute the most to the identified factor), will be identified. The shortened assessment will be created from those items with the highest loadings onto the latent factors. These items will then be evaluated for inclusion based on the criterion in the DSM-V definition they correspond to. It is expected that this will yield items that cover the latent factors of the EFA as well as the criteria included in the DSM-V definition of ASD. With the presence of 272 items, this process will hopefully yield an assessment with an overall factor structure very similar to its parent assessment, the EFA, and compatible with DSM-V.

Confirmatory Factor Analysis

Confirmatory factor analysis (CFA) is used to test one or more underlying models which must be specified in advance to run the analysis (Thompson, 2010). The goal of CFA is to test a specific model or hypothesis (in this case the shortened assessment)

(Osborne, 2008). Some of the issues involved in exploratory factor analysis are not present in CFA. There is no factor rotation because the priori models themselves typically specify simple structure by constraining certain factor pattern coefficients to be zero while freeing others to be estimated. In other words, the items are specified as to the factor they represent and that model is then tested for fit. As a result, the model declares this structure in advance because no measured variable is allowed to function as an indicator for more than one factor (Thompson, 2010). In the case of the shortened assessment the measured variables are the items on the assessment and the factors are those factors inherited from the parent assessment.

This analysis will assess the adequacy of the proposed factor structure and the relationships with the latent factors on the shortened assessment (Bernstein et al., 2003). In other words, CFA serves to assess the content validity of the shortened assessment by measuring its fit to the original data set. CFA produces a chi-square, measuring the fit of the model to the data, where a chi-square of zero indicates a perfect fit (Osborne, 2008). Thus, the smaller the chi-square, the better the fit. CFA also produces other indices of fit including the Normed Fit Index (NFI) and the Comparative Fit Index (CFI). Ideally, both the NFI and the CFI should exceed .95. The Root Mean Square error of Approximation (RMSEA), acts like a residual, and measures how well the model parameters reproduce the population covariances. Ideally, the RMSEA should not exceed .06 (Osborne, 2008). These indices of fit will be utilized to assess how well the shortened assessment measures what the parent assessment measures. The ultimate advantages of the shortened assessment are its brevity and short completion time.

Research Design

This quantitative study looks at an existing data set consisting of participant demographic data (age, gender, and gifted status) and item responses to the 272 question Ellis Functional Assessment for high-functioning autism. The Ellis Functional Assessment is a measurement assessment that examines areas of functional difficulty for people with high-functioning autism. As such, it provides concrete information on areas of functional difficulties associated with high-functioning ASD in educational environments.

This data will be analyzed using exploratory factor analysis to assess how many latent variables are included in the assessment and which items of the assessment load most heavily onto these factors. This information will then be used to design a short 15 to 25 question assessment that can be used in an educational environment to pre-screen students for referral to the child study team for evaluation to receive special educational services for autism spectrum disorders. This assessment will target identifying students at the high-functioning end of the spectrum as research has shown that this group of students tends to be the most under identified (Neihart, 2000).

Sample

Before the data were analyzed, the Institutional Review Board (IRB) for research involving human subjects approved this study. This process involved filling out the Old Dominion University Application for Exempt Research and submitting the form to the IRB committee. An approval letter was received on April 11, 2014. The letter and the required form are contained in Appendix E.

The population for this study includes 538 participants, with identified high-functioning autism who have themselves (or their parents) completed the Ellis Functional Assessment. No identifying information, other than age, ethnicity, and sex, is included in the data. The participants in this study are aged 8-18. All participants are from the mid-Atlantic region. One interesting aspect of this sample is that over 20% of the sample has been identified as gifted, making this sample represent a truly high functioning population. This population contains 86 female students and 453 male students. The population includes 437 White students, 90 African American students, 6 Hispanic students, 1 Asian student, and 7 students identified as "other." The data was obtained by examining all patient files from 2007 through early 2014 of a Mid Atlantic counseling practice, specializing in Autism Spectrum Disorders. Any patient file listing a diagnosis of High-functioning autism or Asperger's Syndrome (under DSM-IV-TR or DSM-V) which contained an EFA was included in this sample. The identifying information was removed from the EFA (except for sex, ethnicity, and age) and the data from the EFA was then entered into a database. Every participant, in this database, has a confirmed diagnosis of HFA or Asperger's Syndrome.

Instrumentation

The instrument used in this study is the Ellis Functional Assessment for high-functioning autism. This assessment is the result of extensive research from a wide variety of sources including recent publications, academic research, and school system evaluations (Deeley, 2011). It has been used in clinical practice for several years (Deeley, 2011). The purpose of the assessment is to identify areas of functional weakness for individuals with HFA to aid in developing appropriate interventions. It is an

ideal source of data for evaluating students who are having social and academic difficulties in school.

This assessment has demonstrated internal validity and reliability (Deeley et al., 2011). Internal validity was established on two levels. First, content validity was established by reviewing the items to establish that they are measuring functionality in areas problematic to people with autism spectrum disorders. Secondly, internal validity was established by the strong correlations (greater than .600) between different sections of the assessment as shown in Table 2 below:

Table 2

Correlations between subscales in the Ellis Functional Assessment

Strong Correlations within the Ellis Functional Assessment	
Subscale	Correlating Subscale
Problems with Social Interaction	Difficulties Interacting with Friends and Others
Problems with Social Interaction	Lack of Social or Emotional Back-and-Forth Interaction
Problems with Non-Verbal Interaction	Difficulties Interacting with Friends and Others
Lack of Social or Emotional Back-and-Forth Interaction	Difficulties Interacting with Friends and Others
Problems with Personal Management and Self Control	Difficulties Interacting with Friends and Others
Problems with Personal Management and Self Control	Negative Reactions to Discipline
Lack of Social or Emotional Back-and-Forth Interaction	Academic Concerns
Unusual, Restricted, and Repetitive Patterns of Behavior, Interests and Activities	Visual Sensitivity
Lack of Social or Emotional Back-and-Forth Interaction	Difficulty Understanding the Specific Behaviors Required for Certain Concepts

(Deeley et al., 2011)

Reliability was established by the very strong correlations (greater than .800) between the past and current scores on the assessment (Deeley et al., 2011).

Research Questions

Research Question 1:

What are the latent factors assessed in the Ellis Functional Assessment for high-functioning autism?

a) Do these factors change when considering populations aged 8 - 12 years or aged 13 - 18 years?

b) Do these factors change when considering gifted verses non-gifted populations?

c) Do these factors change when considering only male or female sub-populations?

Research Question 2:

Given the factors found in research question one, which items from the Ellis Functional Assessment align with which identified Latent Factors?

a) Do these alignments change when considering populations aged 8-12 years or aged 14-18 years?

b) Do these alignments change when considering gifted versus non-gifted populations?

c) Do these alignments change when considering only male or female sub-populations?

Research Question 3:

Can a valid 15 to 25 item pre-screening questionnaire for high-functioning autism be developed using these items and factors?

a) Given the results to the first two research questions, can a single test be developed or is it necessary to develop multiple pre-screening instruments based on age, gender, or gifted status?

Data Collection

The data will be entered into an SPSS data file. There are 538 patient records. The EFA has 270 items (each with 2 parts), a participant number, and 3 demographic items (gender, age, and ethnicity). This will result in 544 data fields for each record. When the data file is complete, data analysis will begin.

Data Analysis

The data will be analyzed for missingness. As there are 23 subcategories with two parts each (resulting in 46 subcategories) for the EFA. Missing data will be replaced with an average of the scores on that individual assessment, from the subcategory in which it occurs. Ellis, the designer of the assessment, uses this approach as it is a common approach on psychological assessments, such as the WISC, and his experience with the EFA suggests it is the correct approach (C.R. Ellis, personal communication, January 14, 2014).

Using SPSS, factors will be analyzed using exploratory factor analysis using Maximum Likelihood extraction with oblique, direct Oblimin rotations and any factor with an Eigen vector magnitude greater than 1 will be considered to represent a latent variable in the analysis. Any inconsistencies in the exploratory factor analysis will be resolved by further refining the factor analysis criteria. Once the number of latent variables has been determined, and matched to the criteria in literature, the analysis will continue to evaluate which items load onto which variables. The analysis will be refined

until each item loads onto at most one variable. The entire analysis procedure will be rerun on subsets of data that are separated first by ages (8-12 and 13-18) and then rerun and separated by gifted status (gifted and non-gifted), and then again by gender (male and female). The results will be compared and further analysis performed as needed.

After all of the subsets have been analyzed, the final analysis will be to determine which questions should be included in the questionnaire. Those that have the highest load scores on the most subsets of data will be considered first. It is hoped that between two and four items can be found that meet this criteria for all factors. These items will then be evaluated as to relevance to an educational environment and a preliminary form of the pre-screening questionnaire will be drafted.

The resultant product will then be evaluated by three means. First, Confirmatory Factor Analysis will be utilized to verify that the shortened assessment retains the same factor structure as the parent assessment. Secondly, the questionnaire will be run on the existing data set to rescore participants using the new assessment. Finally, the assessment will be reviewed by two professionals in the field for usability and applicability: one in a clinical setting and one in an educational setting.

Limitations

The largest potential limitation to this study is the small number of female participants in the data set ($n = 86$). This is reflective of the current diagnosis of ASD in general, where males are diagnosed at over four times the rate of females, making analysis of this subset difficult. The other limitation is that there is no one definitive standard yet for evaluation of high-functioning autism, although DSM-V sets guidelines. This questionnaire is about functionality in educational settings and referral for special

education support services. This limitation may lead to some controversy relative to its potential efficaciousness.

Chapter 4

Results

Overview

Many individuals with HFA remain undiagnosed well into adulthood and do not receive services to assist with their deficit areas (Barnhill, 2007). Diagnosis is further complicated, and may be delayed, when the person's strengths, such as strong vocabulary skills and rote memory, obscure problems in early childhood (Barnhill, 2007).

All of the current instruments for ASD have demonstrated significant weaknesses, including the under identification of HFA, especially with older children, girls, and gifted students (Wilkerson, 2010). Parent and teacher screening tools are ideal instruments for identifying children who are in need of a more comprehensive evaluation (Wilkerson, 2010). Consequently, there is a demonstrated need to develop a simple, effective screening assessment for HFA that is sensitive to female students, gifted students, and older students.

Purpose Statement

The purpose of this study is to develop a short pre-screening assessment to assist school staff in deciding when students should be referred to schools' child study teams for a determination of eligibility for special education services under the category of ASD. This assessment, adapted from the Ellis Functional Assessment, should involve input from both a parent/guardian and an educational professional familiar with the student. Upon completion, it will assist school staff in making appropriate referrals to child study teams. The assessment should be easy to score and not require specialized

training for its implementation. There currently is no pre-screening assessment for high-functioning ASD in school-aged children.

Organization of Chapter

The chapter starts with some preliminary analyses. The first part of these analyses were focused on data. Outliers were examined and those resulting from data entry errors were corrected. Each variable was evaluated for skewness and kurtosis so that the underlying assumptions of normality could be either supported or rejected.

The Ellis Functional Assessment was then re-examined for reliability. It was examined both on the entire data set and on the 8-18 year old subset used for this study. Reliability was also examined for each subcategory of the EFA. This was done to insure the validity of the long assessment prior to preliminary factor analysis as it made no sense to develop a short assessment from a non-validated long assessment. Preliminary factor analysis was used as the basis of answering the first two research questions. Confirmatory factor analysis was used as the basis for designing and testing the new, shorter assessment.

This chapter explains how the data were analyzed in order to answer the three research questions in this dissertation:

Research Question 1:

What are the latent factors assessed in the Ellis Functional Assessment for high-functioning autism?

a) Do these factors change when considering populations aged 8-12 years or aged 13-18 years?

b) Do these factors change when considering gifted verses non-gifted

populations?

c) Do these factors change when considering only male or female sub-populations?

Research Question 2:

Given the factors found in research question one, which items from the Ellis Functional Assessment align with which identified Latent Factors?

a) Do these alignments change when considering populations aged 8-12 years or aged 14-18 years?

b) Do these alignments change when considering gifted versus non-gifted populations?

c) Do these alignments change when considering only male or female sub-populations?

Research Question 3:

To what degree can a valid 15 to 25 item pre-screening questionnaire for high-functioning ASD be developed using these items and factors?

a) Can a single valid assessment be developed or is it necessary to develop multiple pre-screening instruments based on age, gender, or gifted status?

The largest problem involving analyzing this data is tied to the size of the sample. Although a sample containing 380 school age children with HFA, including 64 female students and 101 gifted students is considered to be large relative to ASD research, it is small relative to factor analysis. With 508 items in the analysis (all items that are not demographic or dichotomous in nature), adjustments will have to be made for Preliminary Factor Analysis to run. These adjustments will require weighing the amount

of data lost by excluding items verses the strength of the preliminary factor analysis run on fewer items. This will be described in detail in each of the sections that follow.

Secondly, the results of the factor analyses will be discussed relative to the factors that result and how the items load onto the different factors. These will be analyzed for each of the comparisons contained in the research questions.

Finally, a detailed description of the process involved in creating a short form assessment from the EFA will be presented. This discussion will include both a description of how items were selected and an analysis of the new assessment relative to reliability and validity.

Preliminary Analyses

The data were entered into a database with 538 patient records and 544 variables assigned to each record. These variables included a participant number, three demographic variables (gender, age, and ethnicity), and 540 variables from the Ellis Functional Assessment. The 540 variables are contained in the 23 different subsections of the EFA. There are 270 items which each have a past and current value, thus yielding the 540 variables. The 538 patient records from the practice include all of the EFAs in the patient files for the last seven years.

Data Cleaning

After all of patient records were entered into the database, the data was examined for outliers. All records containing a variable more than four standard deviations from the mean were selected for examination. In total, 32 such records were found. Upon examination, all 32 records were found to contain data entry errors which were then corrected. Following the corrections there were no outliers in the data.

Assumptions

The items were each separately evaluated for kurtosis and skewness. For all items in the EFA, the values for both kurtosis and skewness were between one and negative one. This means that the items meet the assumptions of normality required for factor analysis.

Reliability

The EFA was then reexamined for reliability. A reliability analysis was performed and Cronbach's Alpha was determined to be .993, re-affirming the internal reliability and validity as determined by Deeley et al., 2011.

Each subscale was evaluated for reliability. The past and current data were evaluated separately for each subscale. The results are summarized in table 3 below. As all Cronbach's Alphas were greater than .720, reliability was established for each subsection as well as for the assessment as a whole as shown in Table 3 below.

Table 3

Reliability of Subscale of EFA Relative to Total Data Set

Cronbach's Alpha by Subcategories: EFA Subcategory	Full Data Set Past	Current
1. Problems with Social Interaction (11 items)	.834	.858
2. Difficulties with Nonverbal Interaction (10 items)	.883	.884
3. Problems Sharing Enjoyment, Interests, Or Achievements with Others (7 items)	.931	.914
4. Difficulties Interacting With Friends Or Others (23 items)	.926	.919
5. Unusual, Restricted, And Repetitive Patterns of Behavior, Interests & Activities (20 items)	.882	.874
6. A Lack of Social Or Emotional Back And Forth Interaction (25 items)	.954	.950
7. Academic Concerns (9 items)	.907	.902
8. Qualitative Impairments in Communication (21 items)	.953	.942
9. Major Changes in Environment That Cause Problems (12 items)	.926	.923
10. Possible Motor Problems (9 items)	.866	.855
11. Environmental Confusion (5 items)	.910	.915
12. Visual Sensitivity (13 items)	.876	.872
13. Olfactory Sensitivity (3 items)	.859	.853
14. Auditory Processing (9 items)	.840	.855
15. Tactile Defensiveness (18 items)	.926	.923
16. Movement/Vestibular (6 items)	.776	.778
17. Taste Concerns (4 items)	.726	.720
18. Perceptual Motor (7 items)	.857	.857
19. Personal Management/Self Control (11 items)	.909	.909
20. Difficulty Understanding the Specific Behaviors Required for Certain Concepts (6 items)	.921	.917
21. Health Or Physical Concerns (7 items)	.795	.804
22. Negative Reactions To Discipline (11 items)	.939	.934
23. Previous Diagnoses (6 items)	.788	.774

All scale level variables were then standardized and the standardized values were used for the rest of the study.

The data set was then reduced to the population under consideration in the study, which included children from 8 years of age to 18 years of age. This resulted in the selection of 380 records (312 white, 58 African American, 5 Hispanic, 0 Asian, and 5 other) which will be utilized this study. This set of patient records included records for 64 female students and 101 students who have been identified as gifted. A separate reliability test was run on the EFA with this data set. This produced a Cronbach's Alpha of .996 for the EFA on this data set, indicating excellent reliability. Reliability was also rerun on the subscales of the EFA for this data subset, which demonstrated the reliability of each EFA subscales for this subpopulation and is summarized in Table 4 below.

Table 4

Reliability by Subscale of EFA Relative to 8-18 Data Set

EFA Subcategory	Cronbach's Alpha by Subcategories: 8-18 Data Set Past	Current
1. Problems with Social Interaction (11 items)	.859	.858
2. Difficulties with Nonverbal Interaction (10 items)	.883	.884
3. Problems Sharing Enjoyment, Interests, Or Achievements with Others (7 items)	.931	.925
4. Difficulties Interacting With Friends Or Others (23 items)	.926	.927
5. Unusual, Restricted, And Repetitive Patterns of Behavior, Interests & Activities (20 items)	.882	.874
6. A Lack of Social Or Emotional Back And Forth Interaction (25 items)	.954	.950
7. Academic Concerns (9 items)	.907	.902
8. Qualitative Impairments in Communication (21 items)	.952	.942
9. Major Changes in Environment That Cause Problems (12 items)	.926	.923
10. Possible Motor Problems (9 items)	.866	.855
11. Environmental Confusion (5 items)	.910	.915
12. Visual Sensitivity (13 items)	.876	.872
13. Olfactory Sensitivity (3 items)	.859	.835
14. Auditory Processing (9 items)	.840	.855
15. Tactile Defensiveness (18 items)	.926	.923
16. Movement/Vestibular (6 items)	.776	.778
17. Taste Concerns (4 items)	.726	.720
18. Perceptual Motor (7 items)	.857	.857
19. Personal Management/Self Control (11 items)	.909	.909
20. Difficulty Understanding the Specific Behaviors Required for Certain Concepts (6 items)	.921	.917
21. Health Or Physical Concerns (7 items)	.795	.804
22. Negative Reactions To Discipline (11 items)	.939	.934
23. Previous Diagnoses (6 items)	.788	.774

Preliminary Factor Analysis

Finally, a separate preliminary factor analysis was performed on each subsection and individual item loadings were examined. For all of the preliminary factor analyses in this dissertation, the Maximum Likelihood Method of extraction was selected. This extraction was selected because it focuses on creating factors that reproduce the correlation or covariance matrix in the population verses the sample. It relies on a Bayesian model which reduces the overall variance in the extraction (Thompson, 2010). An oblique factor rotation was used as there are strong correlations between symptoms of ASD and oblique factor rotation is designed for correlated factors. Specifically, the direct Oblimin rotation was used because it controls the degree of correlation between the factors (Thompson, 2010). Prior research and literature supports the argument for optimal results (results that will generalize to other samples and that reflect the nature of the population). Maximum Likelihood factor extraction and direct Oblimin oblique rotation are the best practices when analyzing data from the social sciences (Costello & Osborne, 2005).

Table 5

Subcategory Preliminary Factor Analysis: 8-18 Data Set

EFA Subcategory	Number of factors		Identical factor structure past and current?	Items failing to load on subcategory factors
	Past	Current		
1. Problems with Social Interaction	2	2	No	PCI10P, PCI10C
2. Difficulties with Nonverbal Interaction	2	2	Yes	DNI1P, DNI1C
3. Problems Sharing Enjoyment, Interests, Or Achievements with Others	2	2	Yes	None
4. Difficulty Interacting with Friends Or Others	4	4	No	DIF6P, DIF6C, DIF7P, DIF7C, DIF23P, DIF23C
5. Unusual, Restricted, And Repetitive Patterns of Behavior, Interests & Activities	5	5	Yes	URRB11P, URRB11C
6. A Lack of Social Or Emotional Back And Forth Interaction	3	3	No	LSEI1P,LSEI1C
7. Academic Concerns	2	2	Yes	None
8. Qualitative Impairments in Communication	2	4	No	QIC4P, QIC4C, QIC8P, QIC8C, QIC11P, QIC11C, QIC18P, QIC18C
9. Major Changes in Environment That Cause Problems	2	2	Yes	None
10. Possible Motor problems	1	1	Yes	None
11. Environmental Confusion	1	1	Yes	None
12. Visual Sensitivity	2	2	Yes	VS1P, VS1C, VS2P, VS2C
13. Olfactory Sensitivity	1	1	Yes	None
14. Auditory Processing	2	2	Yes	AP1P, AP1C, AP8P, AP8C, AP9P, AP9C
16. Movement/Vestibular	1	1	Yes	None
17. Taste Concerns	2	2	Yes	None
18. Perceptual Motor	1	1	Yes	None
19. Personal Management/Self Control	2	2	Yes	PMSC1P, PMSC1C, PMSC4P, PMSC4C, PMSC5P, PMSC5C
	1	1	Yes	None

20. Difficulty Understanding the Specific Behaviors Required for Certain Concepts	1	1	Yes No	HPC7P, HPC7C
21. Health Or Physical Concerns	1	2		None
22. Negative Reactions To Discipline	2	2	Yes	PD15P, PD15C
23. Previous Diagnoses				

The Kaiser-Meyer-Olkin (KMO) is a measure of sampling adequacy in factor analysis both overall and for each variable. KMO values greater than 0.8 can be considered good and values of 0.5 through 0.79 can be considered as adequate (Thompson, 2010). All KMO values, except Taste Concerns, were above .77, indicating a great fit between the data and the factor analysis. In the case of Taste Concerns, both past and present were above .5, the bottom acceptable level for factor analysis. Table 6 summarizes the results.

Table 6

Subcategory Preliminary Factor Analysis KMO Values: 8-18 Data Set

EFA Subcategory	KMO*	
	Past	Current
1. Problems with Social Interaction	.884	.861
2. Difficulties with Nonverbal Interaction	.877	.883
3. Problems Sharing Enjoyment, Interests, Achievements with Others	.869	.857
4. Difficulties Interacting With Friends Or Others	.925	.880
5. Unusual, Restricted, And Repetitive Patterns of Behavior, Interests & Activities	.929	.873
6. A Lack of Social Or Emotional Back And Forth Interaction	.937	.937
7. Academic Concerns	.907	.888
8. Qualitative Impairments in Communication	.942	.927
9. Major Changes in Environment That Cause Problems	.931	.934
10. Possible Motor Problems	.864	.846
11. Environmental Confusion	.836	.852
12. Visual Sensitivity	.871	.886
13. Olfactory Sensitivity	.695	.703
14. Auditory Processing	.861	.864
16. Movement/Vestibular	.781	.786
17. Taste Concerns	.557	.542
18. Perceptual Motor	.863	.857
19. Personal Management/Self Control	.902	.888
20. Difficulty Understanding the Specific Behaviors Required for Certain Concepts	.910	.917
21. Health Or Physical Concerns	.825	.825
22. Negative Reactions To Discipline	.904	.904
23. Previous Diagnoses	.773	.783

*all values significant at $p < .0001$

Research Question 1:

What are the latent factors assessed in the Ellis Functional Assessment for high-functioning autism?

An initial factor analysis was run with the 380 patient records and 502 items from the EFA (all non-dichotomous items). It failed because of colinearity and too many

variables. In an effort to reduce both the item count and the colinearity, where it was demonstrated by the factor analyses that the loadings for past and current items were on the same factors for the entire subsection, only the current items were included in the study as they can represent both the past and current items in factor loadings. For those items that did not load onto the factors in their subsection, it was determined that they should be excluded from the study as they do not measure individual function consistent with their subcategory. It was felt that this approach kept the most information in the remaining items while reducing the item total. All together this resulted in keeping 324 items in the study. The removed items are colored light grey in Appendix C.

A preliminary factor analysis was run with the 380 records and the 324 items. It ran at an unsatisfactory level because of too many items and too much colinearity. The model identified 41 factors as having Eigen values greater than 1. It was decided to limit the number of factors to five. This decision was based on the decreasing values of variance contributed by these factors and the very few items that loaded onto them. This decision was also based on research which indicated that overall, it was unlikely that there would be more than five factors involved in identifying individuals with ASD and the presence of only three categories on the definition of ASD in DSM-V (APA, 2013). This was expected to provide a more parsimonious evaluation of the information contained in the data.

Next, additional items were removed from the analysis. Items that failed to load in this run were removed. Items which loaded onto the same factor for both past and current values were reduced to just the current value which was deemed capable of representing both the past and the current functional values for children with ASD in this

sample. These removed items are colored medium grey in Appendix C. The number of remaining items in the analysis reduced to 202.

The factor analysis was performed using Maximum Likelihood extraction with Oblimin rotation. The extraction produced a KMO measure of sampling Adequacy, KMO = .913 (p <.001) which was within the excellent range. The rotation produced Chi-Square goodness of fit test of χ^2= 44606.462 (df = 18716, p < .0001) indicating an excellent fit to the data. The five factors are identified in Figure 2 below.

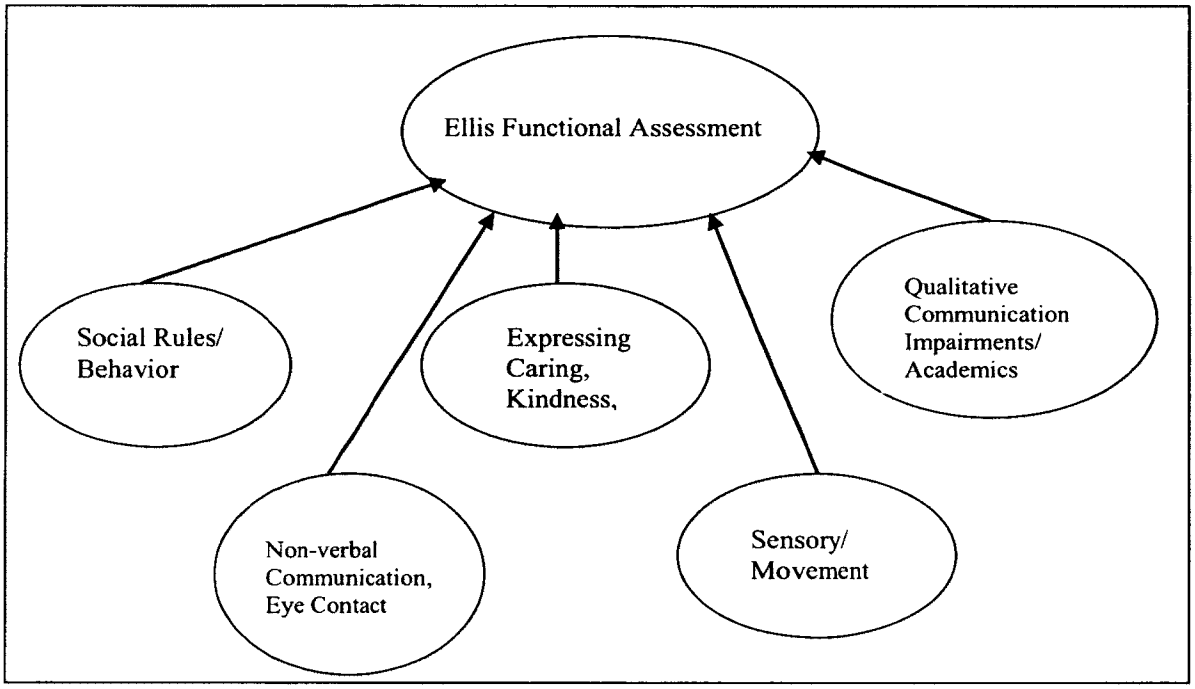

Figure 2. Diagram of Factors Contained in the Ellis Functional Assessment for the Main 8-18 Group

The variance explained by each of the five identified factors and DSM-V association is summarized in Table 7 below.

Table 7

Summary of Factors by Variance Explained and DSM-V Compliance

Factor	Percent Variance Explained Explained by Factor	DSM-V Components Contained in Factor
1. Social Rules/Behavior	28.377	A1, A3, B2
2. Eye Contact/Non-verbal communication	5.471	A1, A2
3. Expressing Emotions (Caring, Kindness, Empathy)	4.093	A1, A2, A3
4. Sensory/Movement	2.940	B1, B3, B4
5. Qualitative Communication Impairments/Academics	2.497	A1, A3

The third requirement of DSM-V is that symptoms must be present in the early development period. This is also covered as each item contains both a past and a current component.

a) Do these factors change when considering populations aged 8-12 years or aged 13-18 years?

The 13-18 years of age subgroup contained 163 records. As such it was not surprising when the factor analysis did not run on 202 items. In order to reduce the number of items while retaining the most information, the decision was made to eliminate items based on their loadings, with the smallest loading eliminated first. The following steps were taken:

1. All factor 1-4 items with loadings less than .400 were dropped factor analysis ran however KMO = .331 which is less than the .5 required for minimal adequacy,
2. All factor 5 items with loadings less than .400 were dropped. Factor analysis ran however KMO = .472 which is still less than the .5 required for minimal adequacy,
3. All factor 1 items with loadings less than .450 were dropped and the factor analysis successfully ran, with the remaining 138 items. The extraction produced a KMO measure of sampling Adequacy, KMO = .571 (p <.001) which was within the adequate range. The rotation produced Chi-Square goodness of fit test of $\chi 2$= 27826.579 (df =9453, p < .0001) indicating a good fit to the data.

Factor Analysis was then run on the 8-12 year old subgroup (202 records) with the same 163 items to insure comparability. It ran successfully. The extraction produced a KMO measure of sampling Adequacy, KMO = .925 (p <.001) which was within the excellent range. The rotation produced Chi-Square goodness of fit test of $\chi 2$= 50655.094 (df =9453, p < .0001) indicating an excellent fit to the data.

The results were then compared. The 13-18 subgroup had a different factor structure than the 8-18 group. The items from the Expressing Emotions factor were dispersed to other factors and the Eye Contact/Nonverbal factor was split into two factors which could be described as Eye Contact/Nonverbal Past factor and Eye Contact Nonverbal Current Factor. It would diagram as follows Figure 3:

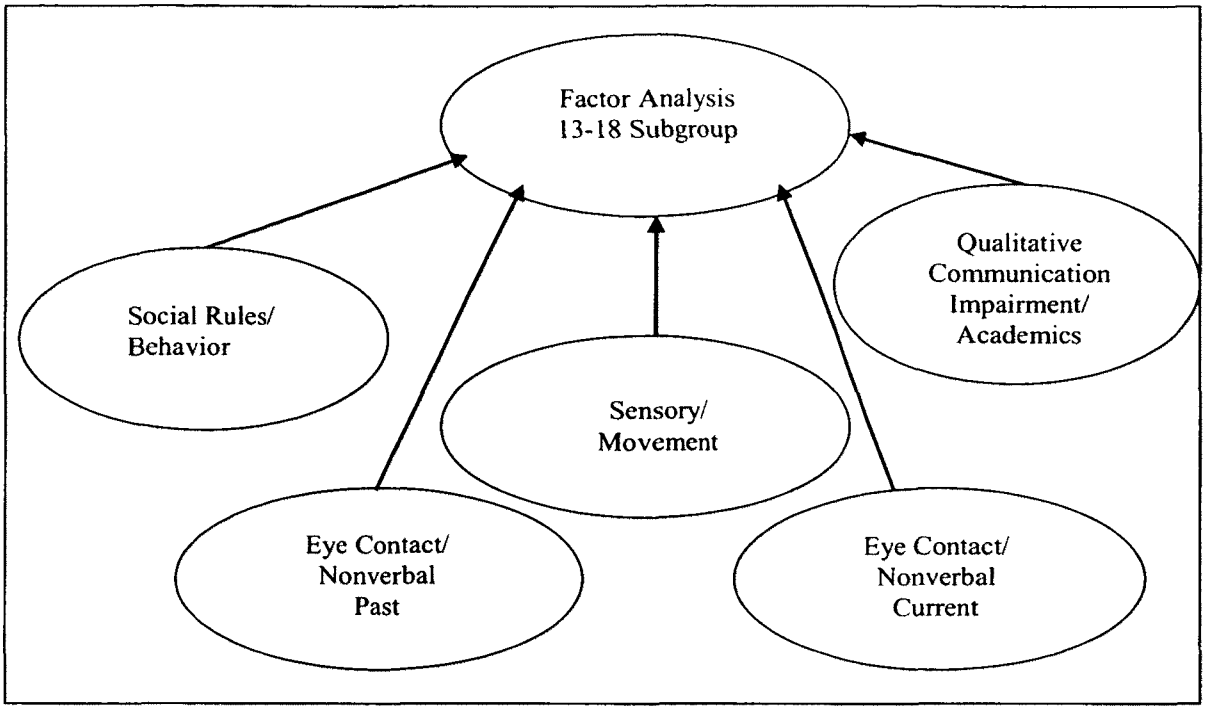

Figure 3. Diagram of Factors Contained in the Ellis Functional Assessment for the 13-18 Subgroup

Interestingly, the 8-12 subgroup factor structure was identical to the 8-18 group with all but one or two items loading on to the same factors. A comparison is summarized in Table 8 below.

Table 8

Comparison of Exploratory Factor Analysis 8-12 Subgroup Verses 13-18 Subgroup

Factor	Factor Rank		Percent Variance Accounted		Total Variance	
	8-12	13-18	8-12	13-18	8-12	13-18
Social Rules/Behavior	1	1	29.704	29.944		
Eye Contact/Non-verbal Communication	2	-----	6.579	----		
Expressing Emotions (Caring, Kindness, Empathy)	3	-----	5.158	----		
Sensory/Movement	4	3	3.416	5.221		
Qualitative Communication Impairments/Academics	5	5	2.969	3.419		
Eye Contact/Non-verbal Communication Past	----	2	----	7.913		
Eye Contact/Non-verbal Communication Current	----	4	----	3.895		
Total					45.809	48.518

The factor analyses run on the 8-12 subgroup and the 13-18 subgroup showed both major similarities and major differences. The Social Rules/Behavior factor was first for both groups and produced the same proportion of accounted for variance. The Qualitative Communication Impairment/Academics and the Sensory/Movement factors also appeared to show very little difference between the two subgroups.

The first major difference is in the Expressing Emotions factor. For the 8-12 subgroup this appears as the third factor and does not appear as a separate factor at all in the 13-18 subgroup. Instead, the items contained in this factor are spread across the other factors indicating that while specific items may cause problems for the older group, the issues do not merit a separate factor. The implication of this is that expressing emotions such as sympathy, caring, and kindness are more problematic for younger children with HFA than for older children with HFA.

Interestingly, for the 13-18 subgroup the Eye Contact/Nonverbal Communication factor is split into two separate factors by the factor analysis. The first factor contains items relating to past behavior and is rated as the second factor and the second new factor is related to current behavior and is rated fourth. Additionally, the variance contributed by the past factor is about double the variance contributed by the current factor. The implication is that the older subgroup has fewer problems with eye contact and nonverbal communication than they did when they were younger. The younger subgroup has this factor listed as second, the same as the older subgroup lists the Past Eye Contact and Nonverbal Communication factor. This is also supportive of the possibility that these issues may be reduced as children grow older.

b) Do these factors change when considering gifted verses non-gifted populations?

The gifted subcategory contained 101 records. Factor analysis was run on this subset using the same 138 items used in section a. Predictably, the analysis failed. The process used in to reduce the number of items while keeping the most information was continued as follows:

1. All factor items with loadings less than .450 were removed (analysis failed),2. All factor items with loadings less than .500 were removed. This time the factor analysis was successfully run with 90 remaining items as demonstrated below. The extraction produced a KMO measure of sampling adequacy, KMO = .503 (p <.001) which was within the adequate range. The rotation produced Chi-Square goodness of fit test of χ^2= 9789.860 (df = 4005, p < .0001) indicating a good fit to the data.

Factor Analysis was then run on the non-gifted subgroup (289 records) with the same 90 items to insure comparability. It ran successfully. The extraction produced a KMO measure of sampling Adequacy, KMO = .916 (p <.001) which was within the excellent range. The rotation produced Chi-Square goodness of fit test of χ2= 23383.691 (df =4005, p < .0001) indicating an excellent fit to the data.

The results were then compared. For the gifted subgroup, most of the items lined up under the factors for the 8-18 group. The factors were ranked in a different order and accounted for different amounts of the variance.

For the non-gifted subgroup, the items lined up under the factors identically to the 8-18 group and the factors even appeared in the same order. The results are summarized in Table 9 below.

Table 9

Comparison of Exploratory Factor Analysis Gifted (G) Subgroup Verses Non-gifted (NG) Subgroup

Factor	Factor Rank		Percent Variance Accounted		Total Variance Accounted	
	NG	G	NG	G	NG	G
Social Rules/Behavior	1	1	31.886	24.734		
Eye Contact/Non-verbal Communication	2	4	7.313	5.211		
Expressing Emotions (Caring, Kindness, Empathy)	3	3	5.482	7.419		
Sensory/Movement	4	2	4.145	10.816		
Qualitative Communication Impairments/Academics	5	5	3.858	3.587		
Total					50.020	48.966

The Social Rules/Behavior factor is the first factor for both groups. Although this factor contributes the most to the total accounted for variance of both groups there are some differences. For the non-gifted subgroup this factor accounts for 13% more of the total accounted for variance than it does for the gifted subgroup. This may suggest that although understanding social rules and behavior is a large problem to both groups, it is less of a problem to the gifted subgroup.

An interesting situation occurs for the Eye Contact/Nonverbal Communication factor. This factor is the number two factor for the non-gifted subgroup and the fourth

factor for the gifted subgroup. This would tend to suggest that eye contact and nonverbal communication is a larger issue for the non-gifted subgroup. The surprising observation is that the proportion of total accounted for variance is more for the gifted group indicating that they, too, have problems in this area.

The Sensory/Movement factor was the second rated factor for the gifted subgroup and the fourth rated factor for the non-gifted subgroup. Additionally, this factor in the gifted subgroup accounted for almost three times the proportion of variance as it did in the non-gifted subgroup. This is highly suggestive that sensory and movement issues may be a greater problem for the gifted subgroup than the non-gifted subgroup.

For the two remaining factors, Expressing Emotions and Qualitative Communication Impairments/Academics, both groups had these as their third and fifth factors respectively and the proportions of total accounted for variance were similar. It does not appear that this would indicate a difference between these two groups relative to these issues.

c) Do these factors change when considering only male or female sub-populations?

The female category contained 64 records. Factor analysis was run on this subset using the same 90 items used in section b. Predictably, the analysis failed. The process used in section a to reduce the number of items while keeping the most information was continued as follows:

1. All factor 1 items with loadings less than .520 were removed (analysis failed),
2. All factor 2 items with loadings less than .520 were removed (analysis failed),

3. All factor 3 and 4 items with loadings less than .520 (there were none in factor were removed (analysis failed),

4. As there were no loadings less than .520 in factor 5, all factor 1 items with loadings less than .550 were removed (analysis failed),

5. All factor 2 items with loadings less than .550 were removed (analysis failed),

6. All factor 3 items with loadings less than .550 were removed. The factor analysis ran successfully with 53 items were remaining. The extraction produced a KMO measure of sampling Adequacy, KMO = .643 (p <.001) which was within the fair range. The rotation produced Chi-Square goodness of fit test of $\chi 2$= 4022.123 (df = 1378, p < .0001) indicating a good fit to the data.

Factor Analysis was then run on the male subgroup (323 records) with the same 53 items to insure comparability. It ran successfully. The extraction produced a KMO measure of sampling Adequacy, KMO = .886 (p <.001) which was within the very good range. The rotation produced Chi-Square goodness of fit test of $\chi 2$= 14075.553 (df = 1378, p < .0001) indicating an excellent fit to the data.

The results were then compared. For the female subgroup, items lined up under the factors listed for the 8-18 set almost identically, except the factors were in a different order and accounted for different amounts of variance.

For the male subgroup, the items lined up under the factors listed for the 8 – 18 group perfectly, but again the factors were in a different order and accounted for different amounts of variance. The results are summarized in Table 10 below.

Table 10

Comparison of Exploratory Factor Analysis Male Subgroup Verses Female Subgroup

Factor	Factor Rank		Percent Variance Accounted		Total Variance Accounted	
	Male	Female	Male	Female	Male	Female
Social Rules/Behavior	1	1	30.004	35.224		
Eye Contact/Non-verbal Communication	3	5	7.209	6.709		
Expressing Emotions (Caring, Kindness, Empathy)	5	2	5.174	8.859		
Sensory/Movement	4	3	6.647	8.196		
Qualitative Communication Impairments/Academics	2	4	8.891	6.997		
Total					53.728	62.354

The difference in the order of the factors and the amount of variance they account for may demonstrate some of the differences in the presentation of HFA between males and females. In fact, almost 10% more of the variance was accounted for by the factors when looking at the female subgroup.

The male subgroup has higher accounted for variances the Eye Contact/Nonverbal Communication factor. Interestingly, the proportion of total accounted for variance of this factor is a third higher than the female subgroup. It is also the third rated factor for the male subgroup as opposed to the last rated factor for the female subgroup. This could indicate that males have more difficulty with humor, sarcasm, reciprocal conversations, and making themselves understood to others.

The accounted for variance on the Qualitative Impairments in Communication factor was slightly higher for males. The proportion of total accounted for variance of this factor is barely higher than the female subgroup. It is however, the second factor listed for the male subgroup as compared to the fourth factor listed for the female subgroup. This may suggest that the male subgroup had slightly more problems with responding to social cues, eye contact, appropriate facial expressions, and sharing in the interests of others.

The female subgroup has higher accounted for variances on the Social Rules/Behavior factor, the Sensory/Movement factor, and the Expressing Emotions factor. This subgroup also had 10% more total variance accounted for than the male subgroup. The higher accounted for variance on the Social Rules/Behavior factor may indicate that difficulties interacting with other people and understanding the social rules therein involved may cause the females more problems than it does for the males. Even so, the proportion of the total variance accounted for by this factor is not very different from the proportion of total variance in the male subgroup. As the factor is listed first for both subgroups it is likely that these are common issues for both males and females. Although the female subgroup's Sensory/Movement factor has a higher Eigen value than the male subgroup, the factor accounts for the same proportion of the total variance. It is listed as the third factor for the female subgroup verses the fourth factor for the male subgroup, which suggests that sensory issues may be a more important problem for females with HFA than for males with HFA.

The largest difference seems related to the Expressing Emotions factor. Here the factor is the second most important for the female subgroup and the last factor in

importance for the male subgroup. Further, this factor accounts for 60% more the total variance than same factor does for the males. This could be an indication that showing the appropriate level of sympathy or showing kindness, consideration, and caring causes more difficulties for the female subgroup than the male subgroup.

Research Question 2:

Given the factors found in research question one, which items from the Ellis Functional Assessment align with which identified Latent Factors?

a) Do these alignments change when considering populations aged 8 – 12 years or aged 13-18 years?

Table 11

Comparison of Five Highest Loading Items 8-12 Subgroup Verses 13-18 Subgroup

Factor		Five Top Loading Items in Descending Order
Social Rules/Behavior	8-12	PMSC4C, LSEI21C PMSC6C, DIF22C, LSEI22C
	13-18	PMSC4C, NRTD7C, DIF22C, DUSB4C, NRTD10C
Sensory/Movement	8-12	TD9C, TD4C, TD16C, TD11C, TD17C
	13-18	TD4C, TD12C, TD2C, AP7C, AP3C
Qualitative Communication Impairments/Academics	8-12	QIC15C, QIC14C, QIC6C, QIC2C, QIC19C
	13-18	QIC15C, QIC16C, QIC5C, QIC7C, QIC10P

As two of the factors are different between the 8-12 subgroup and the 13-18 subgroup, the items were compared for the three common factors to both groups. The first factor, Social Rules/Behavior had some interesting differences. The 8-12 subgroup had items related to *taking turns, following group rules*, and *working independently*

included in their top five loadings for this factor while the 8-13 subgroup had items *related to humor* and *reacting negatively to discipline*. So while they shared items related to the *ability to remain quiet* and *understanding fairness*, they also demonstrated that there are some differences in which issues related to social rules are more problematic for each age group.

The Sensory/Movement factor also showed some differences. The younger subgroup had all tactile items on their top five list. The older subgroup had three items related to *tactile issues* and two related to *auditory issues*.

The Qualitative Communication Impairments/Academics factor also showed different items in the top five loadings for each subgroup. The 8-12 subgroup had items related to *understanding multiple meanings of words, long sentences*, and *word order*. The 13-18 subgroup had items relating to *understanding jokes, understanding sarcasm*, and problems with *reciprocal communications* listed in their top 5 items. This would seem to indicate that the younger group had more general problems in understanding communication while the older group had more problems with the pragmatics of communication.

b) Do these alignments change when considering gifted versus non-gifted populations?

Table 12

Comparison of Five Highest Loading Items Gifted Subgroup Verses Non-gifted Subgroup

Factor		Five Top Loading Items in Descending Order
Social Rules/Behavior	NG	PMSC4C,LSEI21C PMSC6C, PMSC3C, LSEI22C
	G	PMSC4C, DIF22C, LSEI3C, LSEI22C, PMSC6C
Eye Contact/Non-verbal Communication	NG	LSEI12C, LSEI12P, LSEI16C, LSEI19C, LSEI19P
	G	PSE7C, PSE6C, PSE5C, LSEI19C, LSEI12C
Expressing Emotions (Caring, Kindness, Empathy)	NG	DIF16P, DIF15P, DIF16C, DIF17P, DIF15C
	G	DIF16P, DIF17P, DIF15P, DIF16C, DIF15C
Sensory/Movement	NG	TD9C, TD12C, TD16C, TD17C, TD11C
	G	TD2C, TD4C, TD5C, EC1C, TD12C
Qualitative Communication Impairments/Academics	NG	QIC6C, QIC2C, QIC14C, QIC15C, QIC7C
	G	QIC19C, QIC6C, QIC15C, QIC14C, QIC5C

For two of the factors (Social Rules/Behaviors and Expressing emotions) there are no major differences in which five items have the highest loadings. Thus it would seem for these two factors that the same types of issues are present in both the gifted subgroup and the non-gifted subgroup.

For the Eye Contact/Nonverbal Communication factor the top 5 item loadings are different for each subgroup. For both groups *joining into activities with others* seemed to be a problem. For the gifted subgroup, items related to *sharing the interests of others* had the high loadings. For the non-gifted subgroup, *appropriately getting attention* (raising hand and waiting) had high loadings.

For the Sensory/Movement factor, there were both similarities and differences. Both subgroups appear to be *sensitive to certain clothing*. For the non-gifted subgroup,

sensitivity to clothing and textures along with *disliking having hair, face and mouth touched* had the highest loadings. For the gifted subgroup, the high loadings seem to cluster on *disliking crowds*, *not wanting to be touched*, and *only wanting hugs that were self-initiated.*

There were also both similarities and differences related to the Qualitative Communication Impairments/Academics factor. Both subgroups had difficulties with *long sentences*, *multiple meanings of words*, and *understanding people who are speaking too fast.* The non-gifted subgroup also had high loadings on items related to *understanding sarcasm* and *problems with word order*. The gifted subgroup had high loadings on items related to *understanding humor*.

c) Do these alignments change when considering only male or female sub-populations?

Table 13

Comparison of Five Highest Loading Items Male Subgroup Verses Female Subgroup

Factor		Five Top Loading Items in Descending Order
Social Rules/Behavior	Male	LSEI21C, LSEI22C, NRTD10C, LSEI3C, LSEI24C
	Female	LSEI24C, LSEI22C, PCI11C, LSEI13C, NRTD7C
Eye Contact/Non-verbal Communication	Male	LSEI19C, LSEI12P, LSEI19P, PSE6C, PSE7C
	Female	LSEI12C, PSE5C, PSE7C, LSEI19C, PSE6C
Expressing Emotions (Caring, Kindness, Empathy)	Male	DIF16P, DIF15P, DIF17P, DIF16C, DIF15C
	Female	DIF16P, DIF15P,DIF17P, DIF15C, DIF16C
Sensory/Movement Qualitative Communication	Male	TD9C, TD12C, TD10C, TD11C, TD16C
	Female	TD12C, TD10C, TD9C, TD16C, TD11C
Impairments/Academics	Male	QIC6C, QIC2C, QIC14C, QIC15C, QIC3C
	Female	QIC5C, QIC7C, QIC19C, QIC15C, QIC3C

The Social Rules/Behavior factor had more similarities in item loadings than it had differences. Both subgroups had high loadings on items related to *taking turns*, *following the group rules*, and *problems with winning and losing*. The male subgroup also had an item with a high loading related to *problems when denied or not getting his way*. The female subgroup had high item loadings on items related to *problems when not first or does not win* and *problems with leaving an area when told to do so.*

The Eye Contact/Nonverbal Communication, Sensory/Movement, and Expressing Emotions factors did not show any discernible differences as the same or equivalent items had the higher loadings for both subgroups.

The Qualitative Communication Impairments/Academics had both commonalities and differences relative to the two subgroups. Both the male and female subgroups had

problems answering questions and *problems when people speak too fast*. The male subgroup had high loadings on items related to *problems with word order*, *difficulty with long sentences*, and *problems understanding the multiple meanings of words*. The female subgroup had high loadings on items related to *understanding sarcasm and humor*.

Confirmatory Factor Analysis

Research Question 3:

Can a valid 15 to 25 item pre-screening questionnaire for high-functioning autism be developed using these items and factors?

To develop a valid pre-screening questionnaire the items first considered for inclusion were the items with the highest loadings listed for all three comparisons. As these items have high loadings, they contribute a large part of the variance in each factor. As such they may contain the most information about students with HFA. Great care was taken to try to include any item that had a very high loading for either the gifted or female subgroups as they both represent under- identified populations. The third consideration in the selection of items for the short assessment was the inclusion of items that addressed all three parts of DSM-V.

Several possibilities were tested using Confirmatory Factor Analysis. A good model that replicates the same factor structure should produce a CFI > .9. The first several completely failed (CFI < .5). A final model, based on which items worked and did not work in the earlier attempts worked very well. This assessment is designed for parents or guardians of the student to complete. The factors and items in this model are explained below. A copy of the actual assessment is contained in Appendix D.

Factor 1: Social Rules

These first four items were included in the highest 5 loading items for each subgroup.

LSEI20P: Difficulty participating in groups (in the past)

LSEI20C: Difficulty participating in groups (currently)

LSEI21P: Problems following group rules (in the past)

LSEI21C: Problems following group rules (currently)

The next two items appeared in the top 5 loading factors of two groups, gifted students and students aged 13-18 years of age.

DIF22P: Difficulty being fair (will argue a point) (in the past)

DIF22C: Difficulty being fair (will argue a point) (currently)

The last two items assigned to this factor came from the need to comply with DSM-V (it loaded onto this factor in the earlier analyses, just not as highly).

DIF21P: Will not stay an appropriate distance from a person (in the past)

DIF21C: Will not stay an appropriate distance from a person (currently)

Factor 2: Expressing Emotions

All six items assigned to this factor had loadings in the top 5 lists for each subgroup.

DIF15P: Does not understand the concept of being polite (in the past)

DIF15C: Does not understand the concept of being polite (currently)

DIF16P: Does not understand the concept of being kind (in the past)

DIF16C: Does not understand the concept of being kind (currently)

DIF17P: Does not understand the concept of being considerate (in the past)

DIF17C: Does not understand the concept of being considerate (currently)

Factor 3: Qualitative Impairments to Communication

The first six items assigned to this factor appeared in the top 5 lists of most groups; each item appeared on multiple lists.

QIC5P: Problems understanding jokes (in the past)

QIC5C: Problems understanding jokes (currently)

QIC15P: Difficulty when someone is speaking too fast (in the past)

QIC15C: Difficulty when someone is speaking too fast (currently)

QIC16P: Problems with reciprocal communication (in the past)

QIC16C: Problems with reciprocal communication (currently)

The last two items loaded on to this factor for all groups, just not in the top 5. It was included to be more compliant with DSM-V.

AC6P: Needs help to problem solve (in the past)

AC6C: Needs help to problem solve (currently)

Factor 4: Sensory Issues

The first two items were on the top 5 lists of all groups.

TD9P: Dislikes the feel of certain clothing (in the past)

TD9C: Dislikes the feel of certain clothing (currently)

The next two items were on the top 5 list of the gifted subgroup.

EC1P: Problems in crowds (in the past)

EC1C: Problems in crowds (currently)

The next two items loaded on to the sensory factor for all groups but were not in the top 5. Their inclusion is in keeping with the requirements of DSM-V.

VS2P: Is sensitive to light (in the past)

VS2C: Is sensitive to light (in the past)

AP4P: Over-sensitive to sounds (in the past)

AP4C: Over-sensitive to sounds (currently)

Factor 5: Problems with Non-Verbal Communication

The first 6 items loaded onto this factor for all subgroups. They did not necessarily list in the top 5 loadings. They were included because of their high loadings on under identified subgroups.

LSEI9P: Difficulty or inappropriate complimenting (in the past)

LSEI9C: Difficulty or inappropriate complimenting (currently)

LSEI10P: Difficulty or inappropriate offering of help, comfort (in the past)

LSEI10C: Difficulty or inappropriate offering of help, comfort (currently)

LSEI13P: Problems asking for feedback or inappropriate requests for praise (in the past)

LSEI13C: Problems asking for feedback or inappropriate requests for praise (currently)

The last two items were included in the top 5 loadings for this factor in all subgroups.

LSEI19P: Problems asking someone to play or do an activity (in the past)

LSEI19C: Problems asking someone to play or do an activity (in the past)

Table 14

Model evaluations for Confirmatory Factor Analysis: AASC Parent/Guardian Form

Model	Chi Squared (df)	NFI	CFI	RMSEA
Model 1	8730.610 (655)	1.00	1.00	.243
Model 2	5738.068 (645)	1.00	1.00	.142
Model 3	3790.556 (632)	1.00	1.00	.113
Model 4	3490.279 (629)	1.00	1.00	.108
Model 5	3294.790 (627)	1.00	1.00	.104

The results for Model 1 of this confirmatory factor analysis were much better than earlier attempts and produced a model with $\chi^2 = 8730.610$, df = 655 ($p < .001$) and resulted in CFI = 1.00, NFI= 1.00 and RMEA = .243. Modifications that improve model fit are flagged in AMOS as potential changes that can be made to the model. These modifications indices suggest which items should be allowed to covary within factors. After examining the Modification indices, the parameters with indices over 100 were freed and a second, model was then analyzed.

The second iteration produced a model with $\chi 2 = 5738.645$, df = 645 ($p < .001$) and resulted in CFI = 1.00, NFI= 1.00 and RMEA = .142. This represents a significantly better fit ($\chi 2 = 2992.542$ df = 10, $p < 0.00001$). After examining the Modification indices, the parameters with indices over 100 were freed and a third model was then analyzed.

The third iteration produced a model with $\chi 2 = 3790.556$, df = 632 ($p < .001$) and resulted in CFI = 1.00, NFI= 1.00 and RMEA = .113. This represents a significantly better fit ($\chi 2 = 1948.089$ df = 13, $p < 0.00001$). After examining the Modification indices, the 3 parameters with indices over 80were freed and a fourth model was then analyzed.

The third iteration produced a model with $\chi 2 = 3490.279$ df = 629 ($p < .001$) and resulted in CFI = 1.00, NFI= 1.00 and RMEA = .108. This represents a significantly

better fit ($\chi 2$ = 300.227 df = 3, $p < 0.00001$). After examining the Modification indices, the 1 parameter with indices over 100 was found and freed. Additionally, 13 data points Mahalanobis d-squared coefficients greater than 80 were removed and a fourth model was then analyzed.

The fifth iteration produced a model with $\chi 2$ =3294.790, df = 627 ($p < .001$) and resulted in CFI = 1.00, NFI= 1.00 and RMEA = .104. This represents a significantly better fit ($\chi 2$ = 195.489df = 2, $p < 0.00001$). After examining the Modification indices and the outliers, there was nothing left to modify in the model

The high RMESA (above .06) is attributable to the wide variation in the data, which is common when dealing ASD. Also, RMESA tends to be higher the more factors included in the model and this model includes 5 factors (Thompson, 2010, p.130). Overall, this is an excellent model fit that replicates the factor structure of the Ellis Functional Assessment. This model fit gives external validity to the new assessment. It was decided to name this new assessment the Autism Assessment Scale for Children (AASC). The corresponding Confirmatory Factor Analysis path is shown in Figure 4 below.

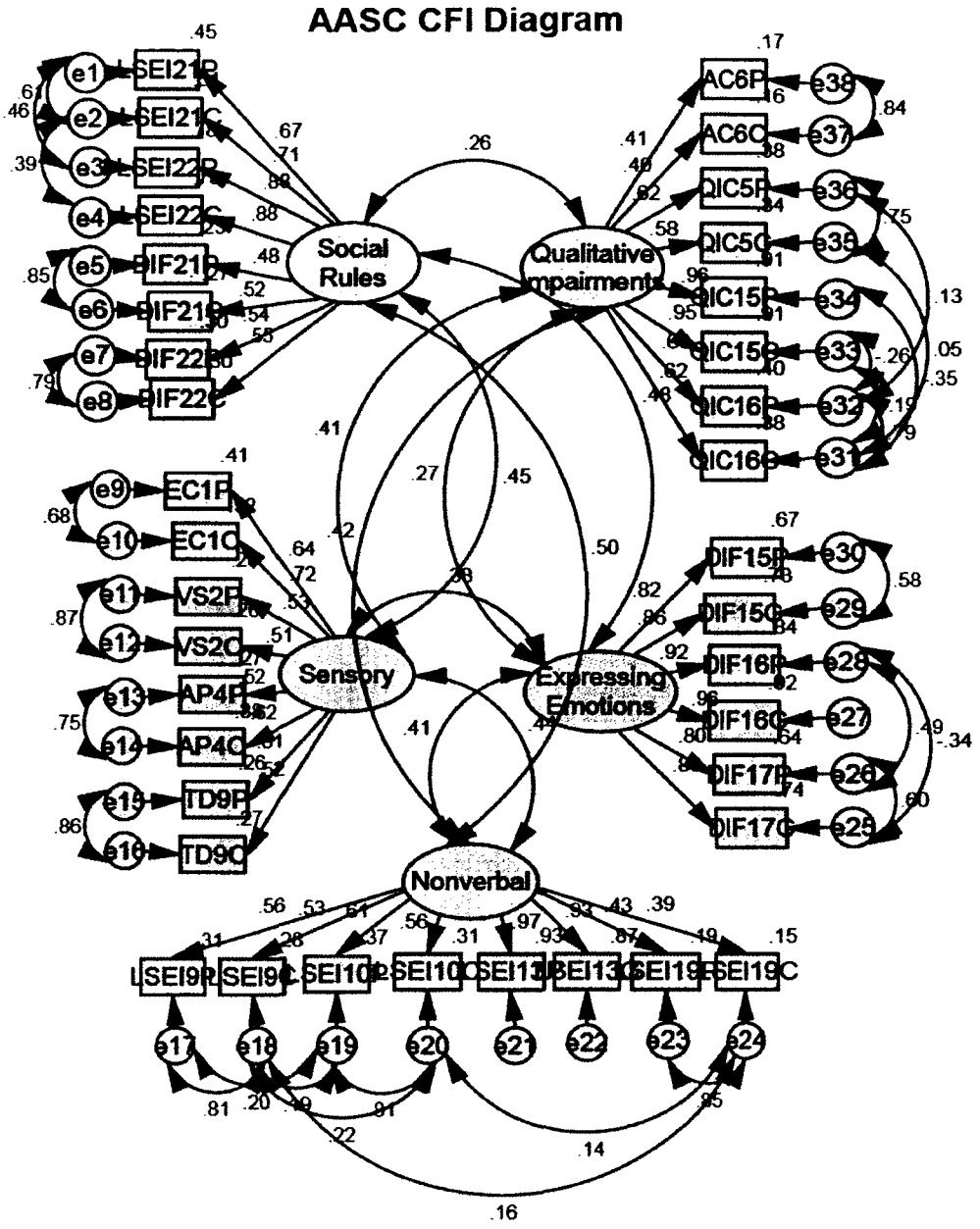

Figure 4. AASC CFI Diagram

The assessment was also evaluated for internal reliability. This resulted in a Cronbach's Alpha = .941, indicating excellent internal reliability. Cutoff scores were established for both the 95% and 90% levels using z-scores. The results are summarized in the table below and indicate that it is possible to use the same or similar cutoff scores for all subgroups included in the analyses.

Table 15

Table of Possible Cutoff Scores: Parent/Guardian Version of Assessment

Group	Mean	Standard Deviation	95% Cutoff Score	90% Cutoff Score
8-18 main group	168.6	77.4	42	75
8-12 subgroup	169.2	78.2	41	75
13-18 subgroup	167.9	76.6	42	76
Gifted subgroup	167.9	73.8	47	79
Non-gifted Subgroup	168.9	78.8	40	74
Male subgroup	165.9	75.7	41	75
Female subgroup	180.7	84.1	43	79

The next step in designing this assessment was to design a version for teachers and other educators to complete. This version of the assessment included all of the current items in the parent/guardian version. The past items, contained on the parent/guardian version have been deleted from this version. This is because teachers and other educators may not have sufficient knowledge of the past behaviors of a student to answer those items.

Confirmatory Factor Analysis was performed on this assessment with the following results.

Table 16

Model evaluations for Confirmatory Factor Analysis: AASC Teacher/Educator Form

Model	Chi-squared (df)	NFI	CFI	RMSEA
Model 1	313.247 (142)	1.00	1.00	.217
Model 2	248.426 (137)	1.00	1.00	.049

The results for Model 1 of this confirmatory factor analysis were not bad and produced a model with $\chi 2 = 313.247$, df = 142 ($p < .001$) and resulted in CFI = 1.00, NFI= 1.00 and RMEA = .217. After examining the Modification indices, the parameters with indices over 100 were freed and a second model was then analyzed.

The second iteration produced a model with $\chi 2 = 248.426$, df = 137 ($p < .001$) and resulted in CFI = 1.00, NFI= 1.00 and RMEA = .049. This represents a significantly better fit ($\chi 2 = 64.821$ df = 5, $p < 0.00001$). Since NFI = 1, CFI = 1, and RMSEA <.06 this model represents an excellent fit and verifies the external validity of this form of the AASC. The corresponding Confirmatory Factor Analysis path is shown in Figure 4 below.

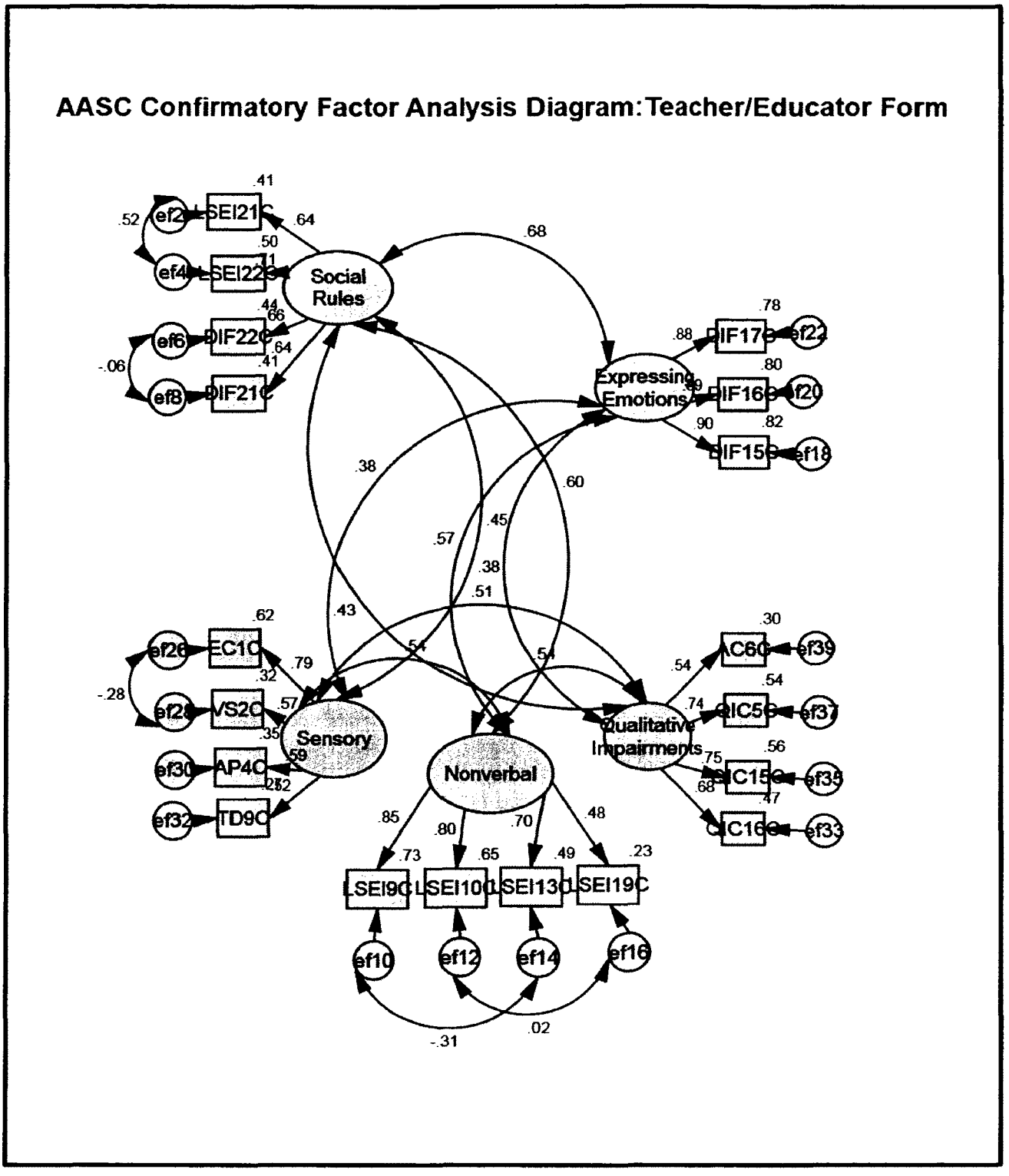

Figure 5. AASC CFI Diagram Teacher/Educator Form

The assessment was also evaluated for internal reliability. This resulted in a Cronbach's Alpha = .889, indicating good internal reliability. Cutoff scores were established for both the 95% and 90% levels using z-scores. The results are summarized in the table below and indicate that it is possible to use the same or similar cutoff scores for all subgroups included in the analyses. A discussion about which cutoff scores were finally accepted and why is contained in the next chapter.

Table 17

Table of Possible Cutoff Scores: Teacher/Educator Version of Assessment

Group	Mean	Standard Deviation	95% Cutoff	90% Cutoff
8-18 main group	79.7	38.8	16	33
8-12 subgroup	81.4	39.2	17	34
13-18 subgroup	77.3	38.1	15	32
Gifted subgroup	80.7	35.6	22	37
Non-gifted subgroup	79.2	39.2	15	32
Male subgroup	77.7	37.7	16	32
Female subgroup	89.0	42.4	19	38

The AASC meets the criteria specified in the design of this assessment. It reflects the factor structure in the Ellis Functional Assessment. This established external validity. The assessment has high internal reliability. The assessment reflects the requirements of DSM-V for ASD. Additionally, as the cutoff scores are higher for gifted students and female students (the subgroups currently under-identified), the assessment is demonstrates additional sensitivity for these groups.

a) Given the results to the first two research questions, can a single test be developed or is it necessary to develop multiple pre-screening instruments based on age, gender, or gifted status?

The above-generated assessment is valid for all subgroups regardless of age, gender, or gifted status. Therefore, it is not necessary to design more than one assessment. All subgroups can be screened on the same assessment.

Chapter 5

Conclusions

Summary

The purpose of this dissertation was to develop a short pre-screening assessment for high functioning autism that could be used by schools to assist in deciding when a student should be referred to the schools' child study teams for an evaluation of ASD. As part of this process, the Ellis Functional Assessment (EFA) was examined with preliminary factor analysis to determine the underlying latent factor structure of the EFA and to determine how this factor structure may vary for under-identified subgroups including older students, gifted students, and female students. The preliminary factor analyses were first compared based on factor structure. Additionally, the item loadings for these analyses were compared to see whether any differences were present between the comparison groups. The results of these comparisons were used to develop a short form pre-screening assessment, the Autism Assessment Scale for Children (AASC), which was tested, using confirmatory factor analysis, to evaluate how well it reflected the latent factor structure of the EFA. The assessment was then evaluated for reliability and analyzed for possible cutoff scores.

Conclusions

The preliminary factor analysis had 21 items with Eigen values over 1.0. Since this was an inordinately large number of factors, a decision was made to limit the number of factors. This decision was based on prior research and the DSM-V criteria for ASD, which suggested that five was the largest number of factors that should be used to reflect the behaviors identified with Autism Spectrum Disorder. These five factors, social

rules/behavior, non-verbal communication/eye contact, expressing caring/kindness, sensory motor, and qualitative impairments in communication/academics covered the majority of the variance in the model and covered the most important aspects of ASD identified in literature. These five factors also cover all of the elements used for diagnosis in DSM-V; persistent deficits in social communication and interaction, as well as restricted and repetitive patterns of behavior, interests or activities. Because of the data in the Ellis Functional Assessment included behavior from early childhood the third requirement of DSM-V, symptoms must be present in the early developmental period (but may not become fully manifest until social demands exceed limited capacities) is satisfied.

The first factor, social rules, accounted for the most variance in the main 8-18 age group and in all of the subgroups (children aged 8 - 12 years, children aged 13 - 18 years, gifted children, non-gifted children, male children, female children). Interpreting social rules appropriately is the principle deficit for people with ASD and even high-functioning individuals with ASD struggle with behaviors anticipated with social rules, even in adulthood (Baron-Cohen, 2002). It is therefore not surprising that this factor was the most important (highest Eigen value) in all of the preliminary factor analyses performed.

The second factor, eye contact/nonverbal interaction, relates to both social and non-verbal communicative behaviors such as making eye contact with people, standing the appropriate distance from people during interactions, raising one's hand to get attention, and the use of other nonverbal gestures. Problems with nonverbal communication such as the inability to read the social cues of their peers, awkward body posture, awkward use of gestures, lack of or fleeting eye contact, and unusual body

language have been described as the reason many children with ASD stand out socially in their peer groups (Church, Alisanski, & Amanullah, 2000).

The third factor, a deficit in expressing key emotions such as kindness, caring, and sympathy, is associated with what is perceived as the lack of empathy from people with ASD. Many individuals with ASD do not express empathy and emotional understanding the same way that neurotypical individuals express these feelings; therefore, the belief by some individuals is that those with ASD do not experience these feelings at all (Freedman, 2007). Consequently, the lack of typical expression of empathy and emotional understanding is a defining characteristic of ASD.

The fourth factor, sensory/movement, encompasses all sensory processing problems, issues with balance, and motor skills. It is important to note that hyper or hypo reactivity to sensory input is now included in the diagnostic criteria for ASD in the DSM-V (APA, 2013). As sensory processing abilities are also prominently aberrant in ASD, this is an important factor to evaluate both in terms of hypersensitivity (such as over sensitivity to certain clothing textures) and in terms of hyposensitivity (such as feeling less pain, or having vestibular balance problems) in identifying individuals with ASD (Filipek et al., 1999).

The fifth factor, qualitative impairments in communication/academics, covers reciprocal interactions, understanding jokes, speech prosody, and understanding/following directions. As the ability to engage in emotionally appropriate reciprocal social interaction is believed to be a core domain of deficiency in all ASD, this is an important factor in the identification of individuals with ASD (Constantino & Todd, 2005).

The five factors cover the DSM-V definition of autism spectrum disorder as shown in the following table:

Table 18

Factor Match with DSM-V

Factor	DSM-V Definition Part A Subparts 1 – 3	DSM-V Definition Part B Subparts 1 – 4
Social Rules	1,3	2,3
Eye Contact/Nonverbal	2,3	2
Expressing Emotions	1,2,3	2
Sensory/Movement		1,4
Qualitative Impairments in Communication/Academics	1,2,3	1,3

The match between DSM-V and individual items is shown in Figure 6 below. The subgroup column explains how different items load on the various subgroups contained in this study

Autism Assessment Scale for Children

DSM-V	Student Characteristic	Subgroups
A2	Will not stay an appropriate distance from a person	All
A1, A3	Difficulty being fair (will argue a point)	G > NG
A1, A3, B3	Problems following group rules	All
A1, B2	Difficulty taking his or her turn	All
A3	Difficulty or inappropriate complimenting	F > M
A1, A2, A3	Difficulty or inappropriate offering of help, comfort	All
A1, A3	Problems asking for feedback or inappropriate requests for praise	All
A1, A3	Problems asking someone to play or do an activity	All
A1, A3	Doesn't understand the concept of being polite	All
A1, A3	Doesn't understand the concept of being kind	All
A1, A3	Doesn't understand the concept of being considerate	All
B4	Problems in crowds	G > NG
B4	Is sensitive to light	All
B4	Over-sensitive to sounds	All
B4	Dislikes the feel of certain clothing	All
B3	Needs help to problem solve	Y > O
B1	Problems understanding jokes	F > M
B1	Difficulty when someone is speaking too fast	All
A1, B3	Problems with reciprocal conversations	G > NG

Figure 6. AASC Item Match to DSM-V. Note: G = Gifted, NG = Non-Gifted, F = Female, M = Male, Y = Younger children, O = Older children.

In order to provide the information in a more organized manner, the remainder of the conclusion section is presented as comparison groups. There are three comparisons, older children (13-18 years) verses younger children (8-12 years), gifted children verses non-gifted children, and male children verses female children. Using the results from the preliminary factor analyses, the differences and commonalities between the comparison

groups are discussed. The assessment is then discussed in terms of design and usability.

Comparing 8 - 12 Year Old Children with 13 - 18 Year Old Children

The findings in this study support prior research and shed some light on why older children with HFA may be harder to diagnose. This analysis was the only comparison where the original factor structure did not hold for both groups. For the 8 – 12 year olds, the basic factor structure was the same as for the main 8 – 18 age group. For the older group, the eye contact/ nonverbal factor was divided into two distinct factors. One of the factors, with the second highest Eigen value, was tied to behavior in the past. The other factor, with the fourth highest Eigen value, was related to the same behaviors in the present. The items related to expressing emotions were divided among all of the other factors for the older group and this did not appear as a separate factor for them. It is evident in the factor analysis for the older subgroup, where the Eigen value for past behavior is more than twice the Eigen value for current behavior, that behavior problems associated with this factor caused significantly more problems for these older children in the past than they do in the present. This analysis supports the findings of prior, longitudinal studies that demonstrate some improvements in autistic symptoms over time, especially in higher functioning children (Mayes, & Calhoun, 2011).

Even where the factors lined up for these two groups, the items with the highest loadings reflect differences in both how these problems affect these children and how the problems may be perceived (see appendix A). The social rules factor, the most important factor for both groups, had items loading onto both subgroups that indicated that problems with *perceived fairness* and *remaining quiet* caused issues for both groups. The younger children also had high loading on items related to *taking turns* and the *ability to*

work independently. Both of these items represent readily observable behavior. For the older children, *not understanding humor* and *responding negatively to discipline* were in the top loading onto this factor. The younger children had the most difficulty with items *related to taking turns* and *the ability to work independently*. Both of the behaviors are readily observable behaviors making it easier to diagnose them with HFA. Conversely, older children had the most difficulty with *understanding humor* and *responding negatively to discipline.* As a result, the older children were often identified as having behavior problems, inappropriate behaviors, or uncaring attitudes rather than being identified as having HFA (Church, Alisanski & Amanullah, 2000). The behaviors common to older children with HFA may be harder to recognize and identify than the behaviors common for the younger children, and may not be correctly attributed to an ASD impairment.

The younger subgroup retained the overall factor structure of the main group including the expressing emotions factor. The items, which loaded onto this factor, were associated with *problems understanding politeness and kindness.* The items also reflected *inappropriate ways of showing caring or sympathy*. Most of these items, again, are highly observable. For the older subgroup, these items were distributed among the other factors and had lower loadings, but these weren't as noticeable in the older children. This would indicate that the older children may still have problems with expressing emotion, however, these problems cause fewer issues for them.

Relative to the sensory/motor factor, the five highest loading items for the younger children were related to tactile issues. These children seem *not to like to be touched, dislike certain clothing,* and *do not want to touch certain tex*tures. The older

subgroup shared three of these items shared the three aforementioned aversions, as well as items relating to *auditory issues such as loud noises*. As the research shows that many young children with ASD also have issues relating tolerating loud noises (Wing, Gould, & Gillberg, 2011). This may indicate that the tactile items are not as large an issue to the older group rather than any differences in problems with loud noise.

Even in the qualitative impairments to communication/academics factor, the items that loaded highly for each group reflect differences not shown by the factors alone. For both groups, this rated as the fifth factor. In spite of this issue, the items that loaded highest onto the factor reflect different qualitative impairments for the two subgroups. The highest loading items for the 8-12 age subgroup reflected *difficulties with long sentences, word order* and *words with multiple meanings*. These would be easy to observe by either parents or teachers and provide evidence of possible impairments. For the older children, the items that presented the biggest barriers were related to *understanding humor* and *reciprocal conversation*, which are more subtle and not often observable behaviors. These findings once again support the notion there is an increased degree of difficulty involved when attempting to identify older children with HFA.

The results from this dissertation paint a picture of the distinct deficits between children with HFA at different ages. For example, younger children with ASD tend to have more difficulty expressing emotions while older children with ASD tend to have more difficulty with reciprocal conversations and humor. Overall, younger children with ASD tend to experience deficits that are easier to observe, making them more likely to be recognized and identified than their older counterparts with ASD, whose more subtle presentations of deficits, makes it harder to identify the existence of a specific disability.

Although improvements may be seen in the social domain, ASD should be considered a lifelong impairment in which symptoms change with development; in fact developmental changes are an integral aspect of ASD (Fecteau et al., 2003). As most of the ASD assessments are normed on younger children with ASD, it is not surprising that many older children slip through the assessment cracks and are not identified. It is important that older children and adolescents are identified as early as possible and provided with appropriate interventions (Farrugia & Hudson, 2006). The inability to correctly identify these older children may have lifelong implications for them.

Comparing Gifted Children with Non-Gifted Children

Several of the findings of this dissertation both support prior research and provide novel information on the differences between gifted (twice-exceptional) and non-gifted children with HFA (Hayashi et al., 2008). The preliminary factor analysis for both subgroups reflected the same factors as the main 8 – 18 age group. The social rules factor was the largest factor for both groups. The main difference between the subgroups was that this factor accounted for 13% more of the accounted for variance in the non-gifted subgroup. This may indicate that even though social rules are a large problem for both subgroups, this factor is less of a problem for the gifted subgroup. This reflects some of the research findings that indicate as IQ increases, symptoms associated with ASD related to social behavior tend to decrease (Mayer, & Calhoun, 2004).

The expressing emotions factor seemed to provide the same level of difficulty to both subgroups. The same items loaded highly on to the factor for both groups indicating that at least for this sample, there are no significant differences.

The eye contact/nonverbal factor was the second largest factor for the non-gifted subgroup and the fourth factor for the gifted subgroup. The items that loaded highly for both groups related to *joining groups* and *joining activities*. This seems to be difficult for both groups. The non-gifted subgroup had high loading items related to the *appropriate ways to get attention* (such as hand raising). The gifted subgroup had problems with *sharing interests with others*, which supports much of the prior research with this subgroup (Wing, Gould, & Gillberg, 2011). These twice-exceptional children who have ASD impairments may have a wide vocabulary and good grammar, but use speech in non-social ways, e.g. to talk only about their special interests (Wing, Gould, & Gillberg, 2011). Overall, the gifted subgroup seemed to have fewer and less obvious issues with *eye contact* and *nonverbal interactions* (as reflected in its lower factor level). It is harder to observe difficulties in sharing interests than it is to observe inappropriate ways of getting attention. These types of issues may be best identified by assessments completed by a parent or guardian, who have had prolonged contact with the child.

The sensory/movement factor was the second factor for the gifted subgroup and the fourth for the non-gifted subgroup. This may indicate that sensory issues are more of a problem for gifted students. While both groups shared three high-loading items related to *clothing sensitivity*, the non-gifted group also had a high loading item indicating a *dislike of having people touch their hair, face, or mouth*. The gifted subgroup had two high-loading items that were unique them. The two items related to a *dislike of crowds* and wanting only *self-initiated hugs*. Both items were related to having enough personal space. It may be that this concern over personal space tends to be more a characteristic of gifted children with HFA than other of children with HFA.

On the last factor, qualitative impairments in communication/academics, both subgroups had this as the fifth factor. Both subgroups rate *speaking fast* and *long sentences* as items that cause problems in understanding. The non-gifted group has items relating to *word order* and *understanding sarcasm* in their top five while the gifted subgroup lists *problems with humor* in their top five items. Again, *problems with word order* is more observable to both teachers and parents than *difficulty with humor* and may help to contribute to the unevenness in diagnosis between gifted and non-gifted populations with HFA.

As in the first comparison, the gifted subgroup generally has less of the overt symptoms of ASD. Additionally, because gifted children have milder symptoms of ASD or tend to learn strategies to compensate for their challenges more quickly, they are less likely to be identified than non-gifted children (Mayes & Calhoun, 2011). Many of the assessments used to identify ASD in children are normed on children with LFA, which have more symptoms and more severe symptoms than do children with HFA. Additionally, it has been suggested, that gifted students could not also have ASD and that their social difficulties are attributable solely to the individual's giftedness (Assouline, Nicpon, & Doobay, 2009). However, based on the latest statistics reported by the Center for Disease Control (2014), 47% of children diagnosed with ASD have average to above average IQ scores. Unfortunately, misconceptions and misunderstanding regarding ASD contribute to the under-identification of this disorder in gifted children.

The finding that the gifted subgroup had more problems coping with crowds appears to be a new finding not previously reported in the literature. Also, the finding that that the gifted subgroup seemed to have more difficulty with unsolicited or other-

initiated hugs, than non-gifted subgroup of children with HFA seems to be a novel discovery. These new findings have the potential to contribute to the understanding of deficits associated with HFA in twice-exceptional children.

Comparing Male Children with Female Children

Because of the small number of female children in the sample ($n = 64$), the preliminary factor analysis for this comparison was run on 53 items. Even with this reduced number of items in the analysis, both differences and commonalities were evident between the male subgroup and the female subgroup. Interestingly, although both subgroups reflected the same five factors as the main 8 – 18 age group, the factors accounted for 10% more of the variance for the female subgroup than for the male subgroup. Most of the factors accounted for the same proportion of total accounted for variance for both groups except for the social rules and expressing emotions factors. The social rules factor accounted for 5% more of the total accounted for variance and the expressing emotions factor accounted for 60% more of the total accounted for variance for the female subgroup. This suggests that understanding social rules and expressing emotions may be larger issues for female children with HFA than for male children with HFA.

For both subgroups, as for all of the other subgroups, the social rules factor was the one accounting for the most variance. Many of the same items strongly loaded onto this factor for both subgroups. The differences that occurred were on two items. For the males, an important item related to *having problems when being denied* something or not getting their way. The female group had a strong loading for an item related to *problems with not winning*. Overall, because of the amount of variance accounted for, it appears

the girls have a harder time with not understanding social rules, especially relative to understanding winning. The boys had very slightly fewer issues with understanding social rules but even so appear to have a harder time than girls when they do not get what they want.

As for the expressing emotions factor, this was the second highest rated factor for the female subgroup and the fifth rated factor for the male subgroup and it accounted for a much larger part of the variance for the female subgroup. The items that loaded in the top five for both groups were the same. This result suggests that while both subgroups have problems with showing emotions such as kindness, caring, and sympathy, these difficulties cause more problems for the female subgroup. This reflects earlier findings that parents reported higher levels of emotional symptoms for girls with ASD than for boys with ASD (Mandy et al., 2012).

The eye contact/nonverbal communication factor rated third for the male subgroup, fifth for the female subgroup, and accounted for slightly less of the variance for the female subgroup. The same items loaded highly onto this factor for both subgroups. It may be that even though both subgroups have problems with eye contact and nonverbal communication, research suggests that members of the female subgroup may be better at camouflaging these difficulties and consequently are perceived as having fewer issues with it. This type of camouflaging involves conscious, observational learning of how to act in a social setting and by adopting social roles and following social scripts (Cooper & Hanstock, 2009). Women who adopt these camouflaging strategies nevertheless report that underneath their superficially sociable behavior, they have to work hard to keep up the mask and find the process exhausting (Lai et al., 2011). This

could also explain why understanding social rules causes more problems for the female subgroup. A good understanding of social rules and expectations may make it easier to camouflage difficulties. Problems with these understandings can make camouflaging difficult and anxiety producing (Mandy et al., 2012).

For both groups, the sensory/movement factor focused tactile problems. The factor was the third rated for the female subgroup and fourth rated for the male subgroup and accounted for a similar amount of the variance. *Uncomfortable clothes* and *unpleasant textures* were the highest loading items for both of these subgroups (Mandy et al., 2012).

The largest differences were found in the qualitative impairment in communication/academic factors. For the male subgroup, this was the second highest factor and for the female subgroup, this was the fourth rated factor. This factor also accounted for more of the variance in the male subgroup as well suggesting that these impairments cause more problems for the male subgroup than for the female subgroup. Boys with ASD have greater difficulties adapting to the school environment than do girls (Mandy et al., 2012). An alternative, and not mutually exclusive explanation is that more of the difficulties experienced at school by females go unnoticed by their teachers (Mandy et al., 2012). The item loadings show additional differences. For both subgroups, *answering questions and people speaking fast* were problematic. For the male subgroup, problems with *word order, long sentences,* and *words with multiple meanings* were the other high loading items. For the female subgroup, *understanding humor and sarcasm* were among the highest loading items. This may explain why boys with ASD have more difficulty adapting to school than do girls with ASD.

The differences between the male subgroup and the female subgroup may explain why females with HFA are an under-identified subgroup. Although both subgroups have similar impairments, there are some unique differences in the presentation of the impairments. The male subgroup reported having a harder time coping when *they did not get their way* during social situations, when faced with *long sentences, complex word order,* and *multiple meanings of words*. All of these difficulties may be observed by parents or teachers and result in the recognition of possible impairment. The female subgroup had problems with *humor, sarcasm,* and *not winning during* social situations, which even when observed, may not be attributed to a specific type of impairment. In addition, females with HFA generally have better language skills than males with HFA and many try to camouflage their difficulties (Lai et al., 2011); therefore, females with ASD may be interpreted as being less severely affected than males with ASD in areas related to language or social competence (McLennan, Lord, & Schopler, 1993). Because female children may exhibit milder stereotyped behavior and less severe difficulties at school, they may be less likely than male children to be identified as having ASD, even though they have the same level of impairment (Mandy et al., 2012). This was partially supported by the low number of female participants in this dissertation as well as in other studies.

The female subgroup in this study demonstrated more subtlety in presentation even though they were all identified as having HFA. Assessments for ASD are normed on male populations and based largely on male presentations of ASD. This may contribute to the under-identification of female children unless assessments, sensitive to

these differences are developed. The differences between the comparison groups are summarized in Figure 7 below.

Younger Children	**Older Children**
1. Problems taking turns 2. Less ability to work independently 3. Problems understanding politeness and kindness 4. Inappropriate ways of showing caring or sympathy 5. Difficulties with long sentences 6. Problems with word order 7. Problems with words with multiple meanings.	1. Problems not understanding humor 2. Respond more negatively to discipline 3. Problems understanding humor 4. Problems with reciprocal conversation 5. More problems with loud noise
Non-Gifted Children	**Gifted Children**
1. Problems with appropriate ways to get attention 2. Dislike of having people touch their hair, face, or mouth 3. Problems with word order 4. Problems understanding sarcasm	1. Problems sharing interests with others 2. Problems with crowds 3. Want only self-initiated hugs 4. Problems understanding humor 5. More sensory issues
Male Children	**Female Children**
1. Problems with complex word order 2. Problems with long sentences 3. Problems with words with multiple meanings 4. Harder time coping when they do not get their way	1. Problems with humor 2. Problems with sarcasm 3. Problems with not winning 4. Less severe difficulties at school

Figure 7. Summary of the Differences Between the Comparison Subgroups.

The Total Picture

For all three comparisons, the under-identified groups showed certain commonalities. All three under-identified groups (older children, gifted children, and

female children) had milder and often more subtle presentations of ASD than children in the more highly identified groups. All three under-identified subgroups demonstrated fewer overt social behavior issues than the identified groups, which could result in a reduced likelihood that parents or teachers will recognize their impairments. Even when concerns are recognized for these under-identified subgroups, the assessments, which are normed on, predominately male, non-gifted, younger populations, may fail to correctly identify ASD in these children. Because of this, it is no surprise that these subgroups continue to be under-identified.

Designing the Assessment

This dissertation resulted in the development of the Autism Assessment Scale for Children (AASC). The AASC shows promise as a possible pre-screening assessment for HFA in school aged children. One important component of the AASC was that its design was based on information from a sample in which all of the participants already had a confirmed diagnoses of HFA. Although individuals with HFA share the same set of core deficits as all individuals with ASD, their symptoms may manifest themselves in ways that are different from individuals with LFA, making accurate identification with assessments normed on children with LFA challenging (Barnhill, 2007).

Parent screening tools are ideal instruments for identifying children who are in need of a more comprehensive evaluation because they yield important information from individuals who know the child the best and are designed to be relatively easy to administer and score (Wilkerson, 2010). Since the EFA was completed by the parents of children previously diagnosed with HFA, it was the ideal data source for the design of this new pre-screening assessment. Additionally, since the EFA contains both past and

present information, it is uniquely suited to designing an assessment compatible with DSM-V which states that ASD symptoms must be present during the early developmental period even if they are not completely manifested until a later age or if they are masked later in life by learned strategies (APA, 2013)

The design process itself was made difficult by the desire to have this assessment demonstrate external validity with the EFA, sensitivity to under-identified groups of children, and to conform to the new DSM-V definition of ASD. External validity was important to establish with the EFA to demonstrate that the assessment is measuring the same information as the EFA. Demonstrating sensitivity to under-identified groups of children was an important goal because it would result in the identification of more of these young people. Conforming to DSM-V was an important goal because it aligned the assessment with the most current diagnostic criteria for ASD and potentially allows the assessment to be used in additional non-educational settings such as clinical settings.

The first focus, external validity, required confirmatory factor analysis to produce a Comparable Fit Index , CFI >.9, Normed Fit Index, NFI > .9 and Root Mean Square Error of Approximation, RMSEA < .06. Comparative fit indices (CFI and NFI) compare the chi-square for the hypothesized model to one from a "null", or "baseline" model which all of the variables are uncorrelated. The Root Mean Square Error of Approximation (RMSEA) analyzes the discrepancy between the hypothesized model, with optimally chosen parameter estimates, and the population covariance matrix. The first few designs failed to produce a CMI > .5, let alone greater than .9.

After more research, an additional model was tried (see Appendix D). The basic design of the model, which did not change from prior attempts, was to include all items

that highly loaded on multiple subgroups. Some of the additional items included were items that were specific to the under-identified groups. These meant including an item relating to *understanding humor* (a problem for girls and gifted children), *discomfort in crowds* (a problem for gifted children), and *difficulty in being fair* (a problem for girls).

Some items were included to bring the assessment in line with DSM-V. These items included *keeping appropriate distances from other people; needing help to problem solve, light sensitivity,* and *sound sensitivity.* Keeping appropriate distances from people supports criterion A 3 of the DSM-V definition of autism (APA, 2013) "deficits in nonverbal communicative behaviors." Needing help to problems solve supports different sub criterion of part A of the DSM-V definition "Persistent deficits in social communication and social interaction across contexts, not accounted for by general developmental delays." The sensory items are supportive of criterion B 4 of the DSM-V definition "hyper- or hypo-reactivity to sensory input or unusual interest in sensory aspects of the environment." These items had loaded on to the appropriate factors in the preliminary factor analyses, but not with very high loadings.

This time the confirmatory factor analysis ran successfully. The CFI = 1.00, NFI = 1.00, but unfortunately the RMSEA was = .243 suggesting the need to improve the model. To improve the model, several items were allowed to covary within factors, which reduced the RMSEA to .104, which though not ideal is definitely better. The wide variance in autism data in general and the presence of five factors played a role in impeding the reduction of this residual error (Rattray & Jones, 2007).

When the second part of the assessment was evaluated, the teacher version (see Appendix D), which only contains the current items, was tested it produced a CFI = 1.00,

NFI = 1.00 and RMSEA of .049 which is well within the accepted criteria. The teacher version does not contain past information as most teachers do not have knowledge of student behavior prior to the current school year. This further suggests that the inclusion of the past items on the parent/guardian form may have generated some of the wider variance so common in autism data. Overall, the results confirm excellent external validity of the assessment relative to the EFA.

Internal reliability was established for both the parent/guardian and teacher/educator versions of the form with Cronbach's Alpha = .941 for the parent/guardian version and Cronbach's Alpha = .889 for the teacher/educator version of the assessment. With both internal reliability and external validity established, the proposed cutoff scores were generated. The cutoff scores were designed so that any child receiving a score on either version of the assessment (parent/guardian or teacher/educator) would be referred to the schools' child study teams for an educational evaluation to determine eligibility for special education (SPED) under the label of ASD.

Originally, the plan was to establish cutoff scores that would suggest that 95% of the current sample would be referred for evaluation to determine eligibility for SPED under ASD using this new assessment. Because the standard deviation for the scores on the AASC were so large this was deemed impractical. These cutoff scores would have been so low that a large number of individuals without ASD would also be referred for further assessment. Because of the high cost of an educational evaluation to determine eligibility for SPED, referring so many students would render the assessment impractical for use in schools. As a result, it was decided that a more reasonable answer would be a 90% cutoff. Although this may sacrifice some of the sensitivity of the assessment, the

likely improvement in specificity was perceived to be a good trade-off. The proposed cutoff scores were based on the total of all values supplied as answers for the items on the assessment.

The score on the AASC is the total of all of the numeric answers provided. The proposed cutoff score is 70 for the parent/guardian form. Because the assessment was designed to be sensitive to the under-identified groups, their 90% cutoff scores were higher. By using the 90% score for the main 8 – 18 age group, the assessment may detect 91% of the gifted subgroup, and 91% of the female subgroup. This increased sensitivity was a component in the design process. This could result in the AASC showing slightly higher sensitivity for these currently under-identified groups, which was one of the goals in this assessment design. The older child subgroup had the same cutoff score as the total population.

The proposed 90% cutoff score for the teacher/educator version of this assessment is 29. As with the parent/guardian version of this assessment, the result may be slightly increased sensitivity for under-identified groups. This cutoff score could result in detection of 93% of the gifted subgroup, and 92% of the female subgroup. The older child subgroup had the same cutoff score as the total population.

This assessment was reviewed by different professionals who had experience with ASD. These professionals included Rick Ellis, the clinical psychologist that developed the original EFA, and a special education teacher with experience with students with ASD, both of whom approved the form for content and design. A family practice physician was asked if this assessment could be helpful in either a family or pediatric practice in assessing when a child should be referred for additional evaluation for ASD.

The doctor felt the AASC could be useful in this context. The parent/guardian version was read by the parent of a child with a diagnosis of HFA and she stated that she felt confident that this form would have identified her child as needing further assessment.

The AASC meets the goals it was designed to meet. It reflects the factor structure of the EFA. It is short and should require less than ten minutes to complete. It is easy to score as the score is just a total of the numbers entered for each item on the form. The AASC has internal reliability. This assessment may be more sensitive to under-identified groups of children with HFA. The assessment covers the definitional requirements for ASD found in DSM-V. Hopefully, with further testing, the AASC will fulfill its current promise.

Limitations

Although this dissertation and the resulting pre-screening tool have the potential to contribute to the field of ASD research, there are some limitations in this dissertation research that should be noted. The primary limitation is the size of the sample. A sample containing 380 children with HFA between the ages of 8 and 18 is considered large when compared to the sample size of most studies of children with ASD. It is a small sample size relative for preliminary factor analysis especially considering the length of the Ellis Functional Assessment. The result was that the number of items had to be reduced for all of the preliminary factor analyses, which resulted in the loss of some of the information contained in those items. This is especially true of the gifted and female subgroups with populations of 101 and 64 respectively. Again, although when considering the typical sample size of these subgroups of individuals with ASD, these numbers were quite large, the comparisons still required the removal of more items to permit these analyses to run.

The ideal sample size of at least 3000 for the preliminary factor analyses had to be compromised in light of the reality of having a sample of 380 and this was less than statistically ideal.

Another limitation results from the sample population coming from a private clinical practice located in the mid-Atlantic region. It is possible that the sample will not represent the individuals with ASD who receive autism assistance from public mental health centers. Additionally, as a result of the private clinic setting, the sample population did not contain large numbers of ethnic minorities which could affect its validity to those populations especially relative to social rules.

The final limitation is related to the use of the Ellis Functional Assessment as a preliminary tool for creation and measurement of the AASC. It is a very long (eight page) assessment that parents of children with ASD must be willing to complete. When all patient files were examined prior to the initiation of the study, it was concluded that not all of the patients had a completed EFA in their file (2% of the patient files missing EFA). Even though this not a large number, there is no way to know whether these absent forms would have had any effect on the results or outcomes of the present research.

Recommendations

The preliminary factor analyses were performed with a sample that was small enough to require items be removed before the analyses would run. It would be helpful to rerun these analyses with a much larger sample ($n > 3000$) in the hopes of either supporting or correcting the results from the analyses contained in this dissertation. It is also suggested that re-running the analyses on a more heterogeneous sample

geographically, and including children who receive services from a public practice would increase the external validity of the results and support generalizing them to a larger community.

The AASC should be piloted in different populations containing both children with HFA and neurotypical children to further evaluate its sensitivity and specificity. These pilot tests could also help to establish the validity of the assessment in different populations including different ethnic groups, different geographical regions and different assessment environments (schools, clinical practices, medical offices). It is hoped with the additional testing and possible refinements, the AASC can become a pre-screening assessment to help identify these currently under-identified groups of children.

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APPENDIX A

Pattern Matrices from Question 1 Factor Analyses

1. 8-18 Main Group Factor Analysis 202 Items, 380 Records

Pattern Matrix 8-18 Group a

	Component				
	1	2	3	4	5
Zscore(PCI1P)		.332			
Zscore(PCI1C)		.481			
Zscore(PCI2C)		.436			
Zscore(PCI3C)		.361			
Zscore(PCI4C)	.436				
Zscore(PCI5C)					
Zscore(PCI6C)		.391			
Zscore(PCI7C)		.643			
Zscore(PCI8C)	.379				
Zscore(PCI9C)	.556				
Zscore(PCI11C)	.633				
Zscore(DNI2C)	.530				
Zscore(DNI3C)		.505			
Zscore(DNI4C)		.424			
Zscore(DNI5C)		.520			
Zscore(DNI6C)		.533			
Zscore(DNI7C)		.515			
Zscore(DNI8C)		.443			
Zscore(DNI9C)		.518			
Zscore(DNI10C)		.627			
Zscore(PSE1C)		.601			
Zscore(PSE2C)		.629			
Zscore(PSE3C)		.598			
Zscore(PSE4C)		.574			
Zscore(PSE5C)		.615			
Zscore(PSE6C)		.626			
Zscore(PSE7C)		.653			
Zscore(DIF1C)	.560				
Zscore(DIF2C)	.543				
Zscore(DIF3C)	.577				
Zscore(DIF4C)	.519				

Pattern Matrix 8-18 Group a

Zscore(DIF5C)	.612				
Zscore(DIF8C)	.601				
Zscore(DIF9P)				.370	
Zscore(DIF9C)	.435				
Zscore(DIF12C)	.460				
Zscore(DIF14C)					
Zscore(DIF15P)					-.582
Zscore(DIF16P)					-.620
Zscore(DIF16C)					-.434
Zscore(DIF17P)					-.608
Zscore(DIF17C)	.477				
Zscore(DIF18C)	.539				
Zscore(DIF20C)	.356				
Zscore(DIF21C)	.445				
Zscore(DIF22C)	.740				
Zscore(URRB6C)			.397		
Zscore(URRB9C)		.305			
Zscore(URRB13C)			.444		
Zscore(URRB15C)			.397		
Zscore(LSEI2P)					-.478
Zscore(LSEI2C)	.491				
Zscore(LSEI3P)	.386				-.477
Zscore(LSEI3C)	.608				
Zscore(LSEI4P)					-.428
Zscore(LSEI4C)	.401				
Zscore(LSEI5P)					-.569
Zscore(LSEI5C)		.349			
Zscore(LSEI6P)					-.573
Zscore(LSEI6C)		.586			
Zscore(LSEI7P)					-.602
Zscore(LSEI7C)					-.352
Zscore(LSEI8P)					-.568
Zscore(LSEI8C)		.421			
Zscore(LSEI9P)					-.609
Zscore(LSEI9C)					-.434
Zscore(LSEI10P)					-.629
Zscore(LSEI10C)					-.478
Zscore(LSEI11P)					-.371
Zscore(LSEI11C)		.475			
Zscore(LSEI12P)					-.623

Pattern Matrix 8-18 Group a

Zscore(LSEI12C)		.597			
Zscore(LSEI13P)					-.515
Zscore(LSEI13C)					-.361
Zscore(LSEI14P)					-.466
Zscore(LSEI14C)		.354			-.321
Zscore(LSEI15P)					-.573
Zscore(LSEI15C)		.434			
Zscore(LSEI16P)					-.435
Zscore(LSEI16C)	.534				
Zscore(LSEI17P)					-.607
Zscore(LSEI17C)					-.502
Zscore(LSEI18P)					-.370
Zscore(LSEI18C)					
Zscore(LSEI19P)					-.570
Zscore(LSEI20C)		.413			
Zscore(LSEI21C)	.633				
Zscore(LSEI22C)	.613				
Zscore(LSEI23C)	.518				
Zscore(LSEI24C)	.575				
Zscore(ACIC)				.471	
Zscore(AC3C)				.426	
Zscore(AC6C)				.525	
Zscore(AC8C)	.431				
Zscore(AC9C)	.407			.335	
Zscore(EC1C)			.544		
Zscore(EC2C)			.562		
Zscore(EC3C)			.467		
Zscore(EC4C)			.567		
Zscore(EC5C)			.485		
Zscore(QIC1C)				.539	
Zscore(QIC2C)				.627	
Zscore(QIC4C)				.413	
Zscore(QIC5C)				.547	
Zscore(QIC6C)				.633	
Zscore(QIC7C)				.554	
Zscore(QIC9C)				.376	
Zscore(QIC10P)					-.331
Zscore(QIC10C)		.543			
Zscore(QIC14C)				.637	
Zscore(QIC15C)				.647	

Pattern Matrix 8-18 Group a

Zscore(QIC16C)				.500	
Zscore(QIC17C)				.391	
Zscore(QIC19C)				.597	
Zscore(QIC20C)				.394	
Zscore(QIC21C)	.303				
Zscore(MCE1C)	.408				
Zscore(MCE2C)	.349				
Zscore(MCE3C)			.446		
Zscore(MC35C)	.398				
Zscore(MCE6C)			.417		
Zscore(MCE7C)			.445		
Zscore(MCE8C)	.429				
Zscore(PMP2C)			.392		
Zscore(PMP3C)			.304		
Zscore(PMP6C)					
Zscore(VS6C)			.469		
Zscore(VS7C)			.527		
Zscore(VS8C)			.466		
Zscore(VS9C)			.535		
Zscore(VS10C)			.418		
Zscore(VS11C)			.592		
Zscore(VS12C)			.547		
Zscore(OS1C)			.573		
Zscore(OS2C)			.533		
Zscore(OS3C)			.517		
Zscore(AP2C)			.524		
Zscore(AP3C)			.549		
Zscore(AP4C)			.573		
Zscore(AP5C)			.550		
Zscore(AP6C)			.517		
Zscore(AP7C)			.622		
Zscore(TD2C)			.575		
Zscore(TD4C)			.668		
Zscore(TD5C)			.507		
Zscore(TD6C)			.595		
Zscore(TD7C)			.510		
Zscore(TD8C)			.431		
Zscore(TD9C)			.677		
Zscore(TD10C)			.639		
Zscore(TD11C)			.671		

Pattern Matrix 8-18 Group a

Zscore(TD12C)			.677		
Zscore(TD16C)			.736		
Zscore(TD17C)			.613		
Zscore(MV2C)			.369		
Zscore(MV4C)			.335		
Zscore(MV5C)			.383		
Zscore(MV6C)			.482		
Zscore(TC1C)			.433		
Zscore(PPM2C)			.368		
Zscore(PPM4C)			.361		
Zscore(PMSC2C)	.585				
Zscore(PMSC7C)	.559				
Zscore(PMSC8C)	.485				
Zscore(PMSC10C)	.619				
Zscore(DUSB1C)	.624				
Zscore(DUSB2C)	.463				
Zscore(DUSB3C)	.572				
Zscore(DUSB4C)	.668				
Zscore(DUSB5C)	.579				
Zscore(DUSB6C)	.359				
Zscore(HPC1C)			.366		
Zscore(HPC2C)			.410		
Zscore(HPC3C)	.457				
Zscore(HPC4C)	.386				
Zscore(HPC5C)	.387				
Zscore(NRTD2C)	.506				
Zscore(NRTD3C)	.485				
Zscore(NRTD4C)	.553				
Zscore(NRTD5C)	.601				
Zscore(NRTD6C)	.609				
Zscore(NRTD7C)	.647				
Zscore(NRTD8C)	.653				
Zscore(NRTD9C)	.622				
Zscore(NRTD10C)	.686				
Zscore(PD10C)	.401				
Zscore(PD21C)	.362				
Zscore(PD22C)	.539				

Extraction Method: Maximum Likelihood.
Rotation Method: Oblimin with Kaiser Normalization.
a. Rotation converged in 26 iterations.

2. 13-18 Subgroup Factor Analysis with 138 items, 163 records

Pattern Matrix 13-18 Subgroup[a]

	Factor				
	1	2	3	4	5
Zscore(PCI2C)				.389	
Zscore(PCI7C)				.536	
Zscore(PCI11C)	.609				
Zscore(DNI2C)	.575				
Zscore(DNI6C)				.428	
Zscore(DNI9C)				.387	
Zscore(DNI10C)				.583	
Zscore(PSE1C)				.741	
Zscore(PSE2C)				.744	
Zscore(PSE3C)				.720	
Zscore(PSE4C)				.687	
Zscore(PSE5C)				.784	
Zscore(PSE6C)				.782	
Zscore(PSE7C)				.768	
Zscore(DIF1C)	.459				
Zscore(DIF2C)	.393				
Zscore(DIF3C)	.556				
Zscore(DIF4C)	.548				
Zscore(DIF5C)	.604				
Zscore(DIF8C)	.591				
Zscore(DIF15P)	.578				
Zscore(DIF15C)	.689				
Zscore(DIF16P)	.560				
Zscore(DIF16C)	.675				
Zscore(DIF17P)	.588				
Zscore(DIF17C)	.655				
Zscore(DIF18C)	.543				
Zscore(DIF20C)	.415				
Zscore(DIF22C)	.737				
Zscore(LSEI2C)	.448				
Zscore(LSEI3C)	.575				
Zscore(LSEI4P)		-.496			
Zscore(LSEI4C)				.541	
Zscore(LSEI5P)		-.636			
Zscore(LSEI5C)				.466	

Pattern Matrix 13-18 Subgroup[a]

Zscore(LSEI6P)		-.680			
Zscore(LSEI6C)				.554	
Zscore(LSEI7P)		-.623			
Zscore(LSEI7C)				.452	
Zscore(LSEI8P)		-.707			
Zscore(LSEI8C)				.436	
Zscore(LSEI9P)		-.668			
Zscore(LSEI9C)		-.499			
Zscore(LSEI10P)		-.624			
Zscore(LSEI10C)		-.495			
Zscore(LSEI11P)		-.474			
Zscore(LSEI11C)				.323	
Zscore(LSEI12P)		-.782			
Zscore(LSEI12C)				.506	
Zscore(LSEI13P)		-.619			
Zscore(LSEI13C)		-.453			
Zscore(LSEI14P)		-.546			
Zscore(LSEI14C)				.413	
Zscore(LSEI15P)		-.651			
Zscore(LSEI15C)				.516	
Zscore(LSEI16C)	.473				
Zscore(LSEI17P)		-.478			
Zscore(LSEI17C)		-.409			
Zscore(LSEI19P)		-.668			
Zscore(LSEI19C)				.557	
Zscore(LSEI20C)				.361	
Zscore(LSEI21C)	.547				
Zscore(LSEI22C)	.575				
Zscore(LSEI23C)	.526				
Zscore(LSEI24C)	.460				
Zscore(ACIC)					.342
Zscore(AC6C)					.525
Zscore(EC1C)			.457		
Zscore(EC2C)			.445		
Zscore(EC3C)			.300		
Zscore(EC4C)			.600		
Zscore(EC5C)			.472		

Pattern Matrix 13-18 Subgroup[a]

Zscore(QIC1C)					.625
Zscore(QIC2C)					.588
Zscore(QIC3C)					.703
Zscore(QIC5C)					.656
Zscore(QIC6C)					.677
Zscore(QIC7C)					.673
Zscore(QIC10P)		-.416			
Zscore(QIC10C)				.413	
Zscore(QIC14C)					.732
Zscore(QIC15C)					.731
Zscore(QIC16C)					.542
Zscore(QIC19C)					.616
Zscore(QIC21C)	.359				
Zscore(MCE3C)			.433		
Zscore(VS7C)			.511		
Zscore(VS9C)			.394		
Zscore(VS10C)					
Zscore(VS11C)			.443		
Zscore(VS12C)			.494		
Zscore(OS1C)			.517		
Zscore(OS2C)			.442		
Zscore(OS3C)			.394		
Zscore(AP2C)			.587		
Zscore(AP3C)			.683		
Zscore(AP4C)			.737		
Zscore(AP5C)			.652		
Zscore(AP6C)			.523		
Zscore(AP7C)			.686		
Zscore(TD2C)			.712		
Zscore(TD4C)			.735		
Zscore(TD5C)			.564		
Zscore(TD6C)			.545		
Zscore(TD7C)			.570		
Zscore(TD8C)			.445		
Zscore(TD9C)			.640		
Zscore(TD10C)			.614		
Zscore(TD11C)			.596		

Pattern Matrix 13-18 Subgroup[a]

Zscore(TD12C)			.718		
Zscore(TD16C)			.664		
Zscore(TD17C)			.655		
Zscore(MV1C)			.537		
Zscore(MV6C)			.537		
Zscore(TC1C)			.359		
Zscore(PPM6C)					.301
Zscore(PMSC2C)	.416				
Zscore(PMSC3C)	.585				
Zscore(PMSC4C)	.778				
Zscore(PMSC6C)	.702				
Zscore(PMSC7C)	.443				
Zscore(PMSC8C)	.383				
Zscore(PMSC9C)	.491				
Zscore(PMSC10C)	.514				
Zscore(PMSC11C)	.506				
Zscore(DUSB1C)	.641				
Zscore(DUSB3C)	.658				
Zscore(DUSB4C)	.735				
Zscore(NRTD2C)	.493				
Zscore(NRTD3C)			.398		
Zscore(NRTD4C)	.607				
Zscore(NRTD5C)	.689				
Zscore(NRTD6C)	.680				
Zscore(NRTD7C)	.740				
Zscore(NRTD8C)	.708				
Zscore(NRTD9C)	.595				
Zscore(NRTD10C)	.712				
Zscore(PD22C)	.491				

Extraction Method: Maximum Likelihood.
Oblimin Rotation Method:
Rotation converged in 13 iterations.

3. 8-12 Subgroup Factor Analysis 138 items, 232 records

8-12 Subgroup Factor Analysis

	Factor				
	1	2	3	4	5
Zscore(PCI2C)		.374			
Zscore(PCI7C)		.473			
Zscore(DNI2C)	.487				
Zscore(DNI6C)		.361			
Zscore(DNI9C)				-.350	
Zscore(DNI10C)		.424			
Zscore(PSE1C)		.497			
Zscore(PSE2C)		.526			
Zscore(PSE3C)		.503			
Zscore(PSE4C)		.476			
Zscore(PSE5C)		.534			
Zscore(PSE6C)		.547			
Zscore(PSE7C)		.566			
Zscore(DIF1C)	.507				
Zscore(DIF2C)	.520				
Zscore(DIF3C)	.527				
Zscore(DIF4C)	.509				
Zscore(DIF5C)	.565				
Zscore(DIF8C)	.533				
Zscore(DIF15P)			-.875		
Zscore(DIF15C)			-.767		
Zscore(DIF16P)			-.899		
Zscore(DIF16C)			-.788		
Zscore(DIF17P)			-.827		
Zscore(DIF17C)			-.689		
Zscore(DIF18C)	.479				
Zscore(DIF20C)	.374				
Zscore(DIF22C)	.677				
Zscore(LSEI2C)	.502				
Zscore(LSEI3C)	.649				
Zscore(LSEI4P)		.312			
Zscore(LSEI4C)	.495				
Zscore(LSEI5P)		.461			
Zscore(LSEI5C)		.547			
Zscore(LSEI6P)		.701			

Pattern Matrix 8-12 Subgroup

Zscore(LSEI6C)		.759			
Zscore(LSEI7P)		.546			
Zscore(LSEI7C)		.566			
Zscore(LSEI8P)		.525			
Zscore(LSEI8C)		.551			
Zscore(LSEI9P)		.495			
Zscore(LSEI9C)		.473			
Zscore(LSEI10P)		.502			
Zscore(LSEI10C)		.538			
Zscore(LSEI11P)		.455			
Zscore(LSEI11C)		.493			
Zscore(LSEI12P)		.760			
Zscore(LSEI12C)		.808			
Zscore(LSEI13P)		.469			
Zscore(LSEI13C)		.437			
Zscore(LSEI14P)		.501			
Zscore(LSEI14C)		.546			
Zscore(LSEI15P)		.574			
Zscore(LSEI15C)		.603			
Zscore(LSEI16C)	.563				
Zscore(LSEI17P)			-.495		
Zscore(LSEI17C)			-.396		
Zscore(LSEI19P)		.684			
Zscore(LSEI19C)		.749			
Zscore(LSEI20C)		.586			
Zscore(LSEI21C)	.709				
Zscore(LSEI22C)	.663				
Zscore(LSEI23C)	.529				
Zscore(LSEI24C)	.640				
Zscore(ACIC)					-.421
Zscore(EC2C)				**-.584**	
Zscore(EC3C)				**-.454**	
Zscore(EC4C)				**-.590**	
Zscore(EC5C)				**-.475**	-.648
Zscore(QIC1C)					-.724
Zscore(QIC2C)					-.647
Zscore(QIC3C)					
Zscore(QIC5C)					-.640
Zscore(QIC6C)					-.728
Zscore(QIC7C)					-.648

Pattern Matrix 8-12 Subgroup a

Zscore(QIC10P)		.451			
Zscore(QIC10C)		.495			
Zscore(QIC14C)					-.732
Zscore(QIC15C)					-.737
Zscore(QIC16C)					-.485
Zscore(QIC19C)					-.673
Zscore(MCE3C)				-.407	
Zscore(VS7C)				-.441	
Zscore(VS9C)				-.449	
Zscore(VS10C)				-.443	
Zscore(VS11C)				-.523	
Zscore(VS12C)				-.450	
Zscore(OS1C)				-.577	
Zscore(OS2C)				-.455	
Zscore(OS3C)				-.461	
Zscore(AP2C)				-.503	
Zscore(AP3C)				-.486	
Zscore(AP4C)				-.531	
Zscore(AP5C)				-.507	
Zscore(AP6C)				-.444	
Zscore(AP7C)				-.594	
Zscore(TD2C)				-.659	
Zscore(TD4C)				-.709	
Zscore(TD5C)				-.582	
Zscore(TD6C)				-.507	
Zscore(TD7C)				-.574	
Zscore(TD8C)				-.468	
Zscore(TD9C)				-.730	
Zscore(TD10C)				-.681	
Zscore(TD11C)				-.686	
Zscore(TD12C)				-.719	
Zscore(TD16C)				-.703	
Zscore(TD17C)				-.674	
Zscore(MV1C)				-.426	
Zscore(MV6C)				-.387	
Zscore(TC1C)				-.419	
Zscore(PPM6C)				-.381	
Zscore(PMSC2C)	.602				
Zscore(PMSC3C)	.630				
Zscore(PMSC4C)	.782				

Pattern Matrix 8-12 Subgroup a

Zscore(PMSC6C)	.708
Zscore(PMSC7C)	.558
Zscore(PMSC8C)	.505
Zscore(PMSC9C)	.522
Zscore(PMSC10C)	.587
Zscore(PMSC11C)	.531
Zscore(DUSB1C)	.549
Zscore(DUSB3C)	.414
Zscore(DUSB4C)	.564
Zscore(NRTD2C)	.485
Zscore(NRTD3C)	.493
Zscore(NRTD4C)	.533
Zscore(NRTD5C)	.516
Zscore(NRTD6C)	.523
Zscore(NRTD7C)	.600
Zscore(NRTD8C)	.620
Zscore(NRTD9C)	.585
Zscore(NRTD10C)	.649
Zscore(PD22C)	.473

Extraction Method: Maximum Likelihood.
Rotation Method: Oblimin with Kaiser Normalization.
Rotation converged in 12 iterations.

4. Gifted Subgroup Factor Analysis 90 Items, 101 Records

Pattern Matrix Gifted Subgroup[a]

	Factor				
	1	2	3	4	5
Zscore(PCI7C)				-.504	
Zscore(PCI11C)	.618				
Zscore(DNI2C)	.561				
Zscore(PSE1C)				-.526	
Zscore(PSE2C)				-.553	
Zscore(PSE3C)				-.581	
Zscore(PSE4C)				-.581	
Zscore(PSE5C)				-.806	
Zscore(PSE6C)				-.812	
Zscore(PSE7C)				-.846	
Zscore(DIF1C)	.557				
Zscore(DIF2C)	.542				
Zscore(DIF3C)	.588				
Zscore(DIF4C)	.569				
Zscore(DIF5C)	.659				
Zscore(DIF8C)	.640				
Zscore(DIF15P)			-.816		
Zscore(DIF15C)			-.707		
Zscore(DIF16P)			-.878		
Zscore(DIF16C)			-.748		
Zscore(DIF17P)			-.833		
Zscore(DIF17C)			-.652		
Zscore(LSEI3C)	.698				
Zscore(LSEI5C)	.490				
Zscore(LSEI6P)				-.505	
Zscore(LSEI6C)				-.621	
Zscore(LSEI8C)				-.522	
Zscore(LSEI10C)				-.407	
Zscore(LSEI12P)				-.519	
Zscore(LSEI12C)				-.664	
Zscore(LSEI14C)				-.510	
Zscore(LSEI15P)				-.498	
Zscore(LSEI15C)				-.647	
Zscore(LSEI16C)	.544				
Zscore(LSEI17P)			-.589		

Pattern Matrix Gifted Subgroup

Zscore(LSEI19P)				-.640	
Zscore(LSEI19C)				-.758	
Zscore(LSEI20C)				-.563	
Zscore(LSEI21C)	.600				
Zscore(LSEI22C)	.688				
Zscore(LSEI23C)	.654				
Zscore(LSEI24C)	.647				
Zscore(EC1C)		.695			
Zscore(EC2C)		.641			
Zscore(EC4C)		.572			
Zscore(QIC1C)					.480
Zscore(QIC2C)					.565
Zscore(QIC3C)					.646
Zscore(QIC5C)					.587
Zscore(QIC6C)					.638
Zscore(QIC7C)					.568
Zscore(QIC10C)		.391			
Zscore(QIC14C)					.584
Zscore(QIC15C)					.602
Zscore(QIC19C)					.685
Zscore(VS11C)			-.354		
Zscore(OS1C)		.464			
Zscore(OS3C)		.440			
Zscore(AP2C)		.491			
Zscore(AP4C)		.539			
Zscore(AP5C)		.319			
Zscore(AP7C)		.400			
Zscore(TD2C)		.790			
Zscore(TD4C)		.784			
Zscore(TD5C)		.737			
Zscore(TD6C)		.455			
Zscore(TD7C)		.658			
Zscore(TD9C)		.667			
Zscore(TD10C)		.611			
Zscore(TD11C)		.642			
Zscore(TD12C)		.681			
Zscore(TD16C)		.593			
Zscore(TD17C)		.606			
Zscore(PMSC2C)	.508				
Zscore(PMSC3C)	.459				

Pattern Matrix Gifted Subgroup

Zscore(PMSC4C)	.869
Zscore(PMSC6C)	.679
Zscore(PMSC7C)	.469
Zscore(PMSC8C)	.439
Zscore(PMSC9C)	.488
Zscore(PMSC10C)	.611
Zscore(PMSC11C)	.536
Zscore(DUSB1C)	.528
Zscore(DUSB4C)	.613
Zscore(NRTD7C)	.558
Zscore(NRTD8C)	.605
Zscore(NRTD9C)	.585
Zscore(NRTD10C)	.624
Zscore(PD22C)	.468

Extraction Method: Maximum Likelihood.
Rotation Method: Oblimin with Kaiser Normalization.
a. Rotation converged in 12 iterations.

5. Non-gifted Subgroup Factor Analysis 90 Items, 289 Records

Pattern Matrix Non-gifted Subgroup[a]

	Factor				
	1	2	3	4	5
Zscore(PCI7C)		.457			
Zscore(PCI11C)	.625				
Zscore(DNI2C)	.495				
Zscore(PSE1C)		.480			
Zscore(PSE2C)		.497			
Zscore(PSE3C)		.490			
Zscore(PSE4C)		.481			
Zscore(PSE5C)		.476			
Zscore(PSE6C)		.478			
Zscore(PSE7C)		.476			
Zscore(DIF1C)	.524				
Zscore(DIF2C)	.527				
Zscore(DIF3C)	.534				
Zscore(DIF4C)	.492				
Zscore(DIF5C)	.549				
Zscore(DIF8C)	.519				
Zscore(DIF15P)			-.891		
Zscore(DIF15C)			-.802		
Zscore(DIF16P)			-.926		
Zscore(DIF16C)			-.839		
Zscore(DIF17P)			-.831		
Zscore(DIF17C)			-.717		
Zscore(DIF22C)	.618				
Zscore(LSEI3C)	.545				
Zscore(LSEI5C)		.512			
Zscore(LSEI6P)		.698			
Zscore(LSEI6C)		.804			
Zscore(LSEI8C)		.500			
Zscore(LSEI10C)		.500			
Zscore(LSEI12P)		.831			
Zscore(LSEI12C)		.880			
Zscore(LSEI14C)		.493			
Zscore(LSEI15P)		.532			
Zscore(LSEI15C)		.564			
Zscore(LSEI16C)	.528				

Pattern Matrix Non-gifted Subgroup

Zscore(LSEI17P)			-.427		
Zscore(LSEI19P)		.702			
Zscore(LSEI19C)		.769			
Zscore(LSEI20C)		.553			
Zscore(LSEI21C)	.731				
Zscore(LSEI22C)	.637				
Zscore(LSEI23C)	.449				
Zscore(EC1C)				.484	
Zscore(EC2C)				.494	
Zscore(EC4C)				.510	
Zscore(QIC1C)					.643
Zscore(QIC2C)					.710
Zscore(QIC4C)					.426
Zscore(QIC5C)					.678
Zscore(QIC6C)					.746
Zscore(QIC7C)					.674
Zscore(QIC10C)		.578			
Zscore(QIC14C)					.693
Zscore(QIC15C)					.681
Zscore(AP2C)				.456	
Zscore(AP4C)				.504	
Zscore(AP5C)				.529	
Zscore(AP7C)				.561	
Zscore(TD2C)				.611	
Zscore(TD4C)				.631	
Zscore(TD6C)				.487	
Zscore(TD9C)				.770	
Zscore(TD10C)				.705	
Zscore(TD11C)				.660	
Zscore(TD12C)				.766	
Zscore(TD16C)				.714	
Zscore(TD17C)				.712	
Zscore(PMSC2C)	.625				
Zscore(PMSC3C)	.705				
Zscore(PMSC4C)	.787				
Zscore(PMSC6C)	.728				
Zscore(PMSC7C)	.611				
Zscore(PMSC8C)	.538				
Zscore(PMSC9C)	.551				
Zscore(PMSC10C)	.614				

Pattern Matrix Non-gifted Subgroup

Zscore(PMSC11C)	.563				
Zscore(DUSB1C)	.516				
Zscore(DUSB4C)	.514				
Zscore(NRTD7C)	.585				
Zscore(NRTD8C)	.611				
Zscore(NRTD9C)	.571				
Zscore(NRTD10C)	.608				
Zscore(PD22C)	.528				

Extraction Method: Maximum Likelihood.
Rotation Method: Oblimin with Kaiser Normalization.
a. Rotation converged in 8 iterations.

6. Female Subgroup Factor Analysis with 53 items, 64 records

Pattern Matrix Female Subgroupa

	Factor				
	1	2	3	4	5
Zscore(PCI11C)	.860				
Zscore(PSE1C)					-.672
Zscore(PSE2C)					-.683
Zscore(PSE3C)					-.695
Zscore(PSE5C)					-.749
Zscore(PSE6C)					-.736
Zscore(PSE7C)					-.745
Zscore(DIF5C)	.370				
Zscore(DIF8C)	.589				
Zscore(DIF15P)		-.958			
Zscore(DIF15C)		-.873			
Zscore(DIF16P)		-.984			
Zscore(DIF16C)		-.856			
Zscore(DIF17P)		-.927			
Zscore(DIF17C)		-.789			
Zscore(DIF22C)	.546				
Zscore(LSEI3C)	.851				
Zscore(LSEI6C)					-.673
Zscore(LSEI12P)					-.688
Zscore(LSEI12C)					-.785
Zscore(LSEI15C)					-.423
Zscore(LSEI16C)	.480				
Zscore(LSEI19P)					-.641
Zscore(LSEI19C)					-.741
Zscore(LSEI20C)	.403				
Zscore(LSEI21C)	.675				
Zscore(LSEI22C)	.865				
Zscore(LSEI24C)	.902				
Zscore(QIC1C)				.504	
Zscore(QIC2C)				.579	
Zscore(QIC3C)				.704	
Zscore(QIC5C)				.803	
Zscore(QIC6C)				.684	
Zscore(QIC7C)				.776	
Zscore(QIC14C)				.693	
Zscore(QIC15C)				.731	

Pattern Matrix Female Subgroup

Zscore(QIC19C)				.754	
Zscore(OS1C)			-.375		
Zscore(TD2C)			-.530		
Zscore(TD4C)			-.511		
Zscore(TD7C)			-.464		
Zscore(TD9C)			-.867		
Zscore(TD10C)			-.877		
Zscore(TD11C)			-.669		
Zscore(TD12C)			-.908		
Zscore(TD16C)			-.671		
Zscore(TD17C)			-.588		
Zscore(PMSC7C)	.451				
Zscore(PMSC10C)	.527				
Zscore(NRTD7C)	.703				
Zscore(NRTD8C)	.609				
Zscore(NRTD9C)	.478				
Zscore(NRTD10C)	.538				

Extraction Method: Maximum Likelihood.
Rotation Method: Oblimin with Kaiser Normalization.
a. Rotation converged in 9 iterations.

7. Male Subgroup Factor Analysis 53 items, 323 records

Male Subgroup Pattern Matrix[a]

	Factor				
	1	2	3	4	5
Zscore(PCI11C)	.644				
Zscore(PSE1C)			-.416		
Zscore(PSE2C)			-.449		
Zscore(PSE3C)			-.430		
Zscore(PSE5C)			-.570		
Zscore(PSE6C)			-.593		
Zscore(PSE7C)			-.594		
Zscore(DIF5C)	.585				
Zscore(DIF8C)	.478				
Zscore(DIF15P)					-.863
Zscore(DIF15C)					-.749
Zscore(DIF16P)					-.914
Zscore(DIF16C)					-.809
Zscore(DIF17P)					-.822
Zscore(DIF17C)					-.677
Zscore(DIF22C)	.650				
Zscore(LSEI3C)	.675				
Zscore(LSEI12P)			-.784		
Zscore(LSEI15C)			-.553		
Zscore(LSEI16C)	.615				
Zscore(LSEI19P)			-.730		
Zscore(LSEI19C)			-.805		
Zscore(LSEI20C)			-.531		
Zscore(LSEI21C)	.755				
Zscore(LSEI22C)	.709				
Zscore(LSEI24C)	.655				
Zscore(QIC1C)		.701			
Zscore(QIC2C)		.784			
Zscore(QIC3C)		.702			
Zscore(QIC5C)		.691			
Zscore(QIC6C)		.808			
Zscore(QIC7C)		.683			
Zscore(QIC14C)		.739			
Zscore(QIC15C)		.728			
Zscore(QIC19C)		.699			

Male Subgroup Pattern Matrix

Zscore(OS1C)				.464	
Zscore(TD2C)				.522	
Zscore(TD4C)				.551	
Zscore(TD7C)				.485	
Zscore(TD9C)				.851	
Zscore(TD10C)				.748	
Zscore(TD11C)				.681	
Zscore(TD12C)				.848	
Zscore(TD16C)				.636	
Zscore(TD17C)				.589	
Zscore(PMSC7C)	.407				
Zscore(PMSC10C)	.569				
Zscore(NRTD7C)	.632				
Zscore(NRTD8C)	.662				
Zscore(NRTD9C)	.643				
Zscore(NRTD10C)	.683				

Extraction Method: Maximum Likelihood.
Rotation Method: Oblimin with Kaiser Normalization.
a. Rotation converged in 14 iterations.

APPENDIX B
Ellis Functional Assessment and Variable Key

Ellis Functional Assessment

NAME:_____ **DATE:**_____

COMPLETED BY:_____

Ratings—Please rate from 0 to 10 on the characteristics listed below
0 = No Problems/Difficulty, 5 = Moderate Problems/Difficulty, 10 = Severe Problems/Difficulty

Problems With Social Interaction: ***PCI***	**In the Past**	**Currently**
Wanting and needing to be left alone at times	*PCI1P*	*PCI1C*
Trouble with back and forth social interactions	*PCI2P*	*PCI2C*
Inability to respond to social cues	*PCI3P*	*PCI3C*
Inability to understand how someone else might feel	*PCI4P*	*PCI4C*
Inappropriate giggling or laughing	*PCI5P*	*PCI5C*
Impaired imitation – not engaging in simple games of childhood	*PCI6P*	*PCI6C*
Lack of socially directed smiles	*PCI7P*	*PCI7C*
Asks a lot of questions as a way of interacting	*PCI8P*	*PCI8C*
Inappropriately intrusive in social situations	*PCI9P*	*PCI9C*
Mimicking actions from TV, but won't interact	*PCI10P*	*PCI10C*
Problems when not first or doesn't win	*PCI11P*	*PCI11C*

Difficulties With Nonverbal Interaction: ***DNI***		
Not accepting cuddling, hugging, touching unless self-initiated	*DNI1P*	*DNI1C*
Gets in other's space	*DNI2P*	*DNI2C*
No eye contact or stares at the wrong time (circle which)	*DNI3P*	*DNI3C*
Difficulty with non-verbal gestures (too little or too much)	*DNI4P*	*DNI4C*
Problems with eye to eye contact	*DNI5P*	*DNI5C*
Difficulty looking at person talking appropriately	*DNI6P*	*DNI6C*
Difficulty making appropriate facial expressions	*DNI7P*	*DNI7C*
Awkward body postures	*DNI8P*	*DNI8C*
Appears to be stiff	*DNI9P*	*DNI9C*
Lacks hand gestures	*DNI10P*	*DNI10C*

Problems Sharing Enjoyment, Interests, Or Achievements With Others: ***PSE***		
Difficulty sharing in excitement of others	*PSE1P*	*PSE1C*
Difficulty sharing in enjoyment of others	*PSE2P*	*PSE2C*
Difficulty sharing in the interests of others	*PSE3P*	*PSE3C*
Difficulty sharing in the achievements of others	*PSE4P*	*PSE4C*
Difficulty showing others objects of interest	*PSE5P*	*PSE5C*
Inability to bring objects of interest to others	*PSE6P*	*PSE6C*
Difficulty pointing out objects of interests to others	*PSE7P*	*PSE7C*

Ellis Functional Assessment **Page 2**

Ratings---Please rate from 0 to 10 on the characteristics listed below
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Difficulties Interacting with Friends or Others: ***DIF***	**In the Past**	**Currently**
Overreact/difficulty with bullying	*DIF1P*	*DIF1C*
Overreact/difficulty with being teased	*DIF2P*	*DIF2C*
Does not like being left out	*DIF3P*	*DIF3C*
Reacts negatively when interrupted	*DIF4P*	*DIF4C*
Experiences difficulty when ignored	*DIF5P*	*DIF5C*
Fears losing people who are valuable	*DIF6P*	*DIF6C*
Difficulty listening at an appropriate level	*DIF7P*	*DIF7C*
Makes inappropriate comments	*DIF8P*	*DIF8C*
When answering questions may be off the topic	*DIF9P*	*DIF9C*
Says yes/no – just to get someone off his or her back	*DIF10P*	*DIF10C*
Difficulty accepting help from others	*DIF11P*	*DIF11C*
Accepting that some request cannot be complied with	*DIF12P*	*DIF12C*
Inability to make choices	*DIF13P*	*DIF13C*
Obsessed with specific friends (that may not like him or her)	*DIF14P*	*DIF14C*
Does not understand the concept of being polite	*DIF15P*	*DIF15C*
Does not understand the concept of being kind	*DIF16P*	*DIF16C*
Does not understand the concept of being considerate	*DIF17P*	*DIF17C*
Difficulties with tattling – too little or too much (circle which)	*DIF18P*	*DIF18C*
Honest to a fault	*DIF19P*	*DIF19C*
Will not walk away while someone is talking	*DIF20P*	*DIF20C*
Will not stay an appropriate distance from a person	*DIF21P*	*DIF21C*
Difficulty being fair (will argue a point)	*DIF22P*	*DIF22C*
Difficulty making friends	*DIF23P*	*DIF23C*

Unusual, Restricted, And Repetitive Patterns Of Behavior, Interests, & Activities: ***URRB***		
Will watch videos or video segments over and over	*URRB1P*	*URRB1C*
Will play video or computer games for extended periods	*URRB2P*	*URRB2C*
Will play Pokémon or similar games for extended periods of time	*URRB3P*	*URRB3C*
Will line up and/or ordering objects	*URRB4P*	*URRB4C*
Strong attachment to objects – list:	*URRB5P*	*URRB5C*
Fascination with movement (spinning wheels, fans door, drawers)	*URRB6P*	*URRB6C*
Pacing, running back and forth or running round and round	*URRB7P*	*URRB7C*
Licking, smelling, touching things around him/her	*URRB8P*	*URRB8C*
Insistence on routines, resisting change	*URRB9P*	*URRB9C*
Negative reaction to change in environment	*URRB10P*	*URRB10C*
Perfectionist, problems with correction or "mistakes"	*URRB11P*	*URRB11C*
Difficulty with unstructured time	*URRB12P*	*URRB12C*
Staring at patterns, lights, or shiny surfaces	*URRB13P*	*URRB13C*
Lack of fear of real danger	*URRB14P*	*URRB14C*
Excessive fearfulness of some harmless objects or situations	*URRB15P*	*URRB15C*
Obsessive cleaning	*URRB16P*	*URRB16C*
Obsessed with "bad words"	*URRB17P*	*URRB17C*
Moves parts of body a great deal	*URRB18P*	*URRB18C*
Overreacts to possible loss of pet(s)	*URRB19P*	*URRB19C*
Worries about losing things of value	*URRB20P*	*URRB20C*

Ellis Functional Assessment **Page 3**

Ratings---Please rate from 0 to 10 on the characteristics listed below
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A Lack Of Social Or Emotional Back and Forth Interaction: *LSEI* In the Past Currently

Difficulty imitating modeled behaviors	*LSEI1P*	*LSEI1C*
Difficulty sharing with others	*LSEI2P*	*LSEI2C*
Problems taking turns	*LSEI3P*	*LSEI3C*
Difficulty sitting and participating in groups	*LSEI4P*	*LSEI4C*
Inability to negotiate with others	*LSEI5P*	*LSEI5C*
Difficulty initiating social interactions	*LSEI6P*	*LSEI6C*
Difficulty engaging in appropriate play with others	*LSEI7P*	*LSEI7C*
Inappropriate or no greeting of others	*LSEI8P*	*LSEI8C*
Difficulty or inappropriate complimenting	*LSEI9P*	*LSEI9C*
Difficulty or inappropriate offering of help, comfort	*LSEI10P*	*LSEI10C*
Difficulty asking for help, or seeking comfort	*LSEI11P*	*LSEI11C*
Difficulty inviting others to join in	*LSEI12P*	*LSEI12C*
Problems asking for feedback or inappropriate requests for praise	*LSEI13P*	*LSEI13C*
Difficulty asking for an appropriate favor	*LSEI14P*	*LSEI14C*
Inability to engage in social chat	*LSEI15P*	*LSEI15C*
Problems getting attention in appropriate way, raising hand, waiting	*LSEI16P*	*LSEI16C*
Inappropriate display of caring when someone is hurt or sick	*LSEI17P*	*LSEI17C*
Difficulty letting someone know that he or she is hurt or sick	*LSEI18P*	*LSEI18C*
Problems asking someone to play or do an activity	*LSEI19P*	*LSEI19C*
Difficulty participating in groups	*LSEI20P*	*LSEI20C*
Problems following group rules	*LSEI21P*	*LSEI21C*
Difficulty taking his or her turn	*LSEI22P*	*LSEI22C*
Difficulty dealing with the concept of majority rules	*LSEI23P*	*LSEI23C*
Problems with winning and losing	*LSEI24P*	*LSEI24C*
Inappropriate response to misfortune of others-laughing-ignoring	*LSEI25P*	*LSEI25C*

Academic Concerns: ***AC***

Uneven profile of skills (Verbal vs. Nonverbal skills)	*AC1P*	*AC1C*
Well-developed long term memory vs. poor short term memory	*AC2P*	*AC2C*
Over or under generalization of learning	*AC3P*	*AC3C*
Good visual skills	*AC4P*	*AC4C*
Problems organizing	*AC5P*	*AC5C*
Needs help to problem solve	*AC6P*	*AC6C*
Taking too long to complete task	*AC7P*	*AC7C*
Difficulty starting tasks	*AC8P*	*AC8C*
Difficulty organizing tasks	*AC9P*	*AC9C*

Ellis Functional Assessment **Page 4**

Ratings---Please rate from 0 to 10 on the characteristics listed below
0 = No Problems/Difficulty, 5 = Moderate Problems/Difficulty, 10 = Severe Problems/Difficulty

Qualitative Impairments In Communication:	***QIC***	**In the Past**	**Currently**
Problems with pronouns (I, you, he/she)		*QIC1P*	*QIC1C*
Problems with work order		*QIC2P*	*QIC2C*
Problems answering questions		*QIC3P*	*QIC3C*
Problems responding to directions		*QIC4P*	*QIC4C*
Problems understanding jokes		*QIC5P*	*QIC5C*
Problems understanding multiple meaning of words		*QIC6P*	*QIC6C*
Problems understanding sarcasm, idioms, and figures of speech		*QIC7P*	*QIC7C*
Echoing what is said directly, later, or in a slightly changed way		*QIC8P*	*QIC8C*
Uses the phrases from videos or songs in a speech		*QIC9P*	*QIC9C*
Rarely initiates communication		*QIC10P*	*QIC10C*
Always initiating conversation on the area of interest		*QIC11P*	*QIC11C*
Difficulty understanding abstract concepts		*QIC12P*	*QIC12C*
Difficulty with vague concepts		*QIC13P*	*QIC13C*
Difficulty with long sentences		*QIC14P*	*QIC14C*
Difficultly when someone is speaking too fast		*QIC15P*	*QIC15C*
Problems with reciprocal conversations		*QIC16P*	*QIC16C*
Problems with speech (monotone, lack of emotion)		*QIC17P*	*QIC17C*
Difficulty being understood		*QIC18P*	*QIC18C*
Difficulty understanding		*QIC19P*	*QIC19C*
Problems with not having enough information		*QIC20P*	*QIC20C*
Problems when not given choices		*QIC21P*	*QIC21C*

Major Changes In Environment That Cause Problems:	***MCE***	
Reacts negatively to alterations in school schedule	*MCE1P*	*MCE1C*
Problems with changes in school personnel	*MCE2P*	*MCE2C*
Problems with changes in transportation routines	*MCE3P*	*MCE3C*
Difficulties with changes at work	*MCE4P*	*MCE4C*
Problems with the schedule changes in the home	*MCE5P*	*MCE5C*
Difficulties with activity location changes	*MCE6P*	*MCE6C*
Problems when friend or classmate is absent	*MCE7P*	*MCE7C*
Difficulties when family member or friend is late or not coming	*MCE8P*	*MCE8C*
Overreact when anticipating an event or activity	*MCE9P*	*MCE9C*
Difficulties when there is cancellation of an event or activity	*MCE10P*	*MCE10C*
Reacts negatively to having to wait too long	*MCE11P*	*MCE11C*
Wants to wear the same clothing despite changes in weather	*MCE12P*	*MCE12C*

Ellis Functional Assessment **Page 5**

Ratings---Please rate from 0 to 10 on the characteristics listed below
0 = No Problems/Difficulty, 5 = Moderate Problems/Difficulty, 10 = Severe Problems/Difficulty

Possible Motor Problems: ***PMP***	**In the Past**	**Currently**
Clumsiness	*PMP1P*	*PMP1C*
Difficulty with balance	*PMP2P*	*PMP2C*
Difficulty riding a bicycle	*PMP3P*	*PMP3C*
Stiffness muscle – diagnosed physical problem (yes/no)	*PMP4P*	*PMP4C*
Motor planning – can't seem to make the body do what it needs to do	*PMP5P*	*PMP5C*
Motor fatigue – tired easily	*PMP6P*	*PMP6C*
Lack of muscle strength	*PMP7P*	*PMP7C*
Perceptual motor, spacing, sequencing, printing, writing (circle)	*PMP8P*	*PMP8C*
Ability to manipulate items better than paper-pencil abilities	*PMP9P*	*PMP9C*

Environmental Confusion: ***EC***

Problems in crowds	*EC1P*	*EC1C*
Difficultly when surrounded by too much movement	*EC2P*	*EC2C*
Difficulty when surrounded by competing visual stimuli	*EC3P*	*EC3C*
Difficulty not having enough space	*EC4P*	*EC4C*
Being off the pace of others	*EC5P*	*EC5C*

Visual Sensitivity: ***VS***

Has been diagnosed with a visual problem	*VS1P*	*VS1C*
Is sensitive to light	*VS2P*	*VS2C*
Is distracted by visual stimuli	*VS3P*	*VS3C*
Enjoys watching moving things/bright objects	*VS4P*	*VS4C*
Has visual tracking problem – diagnosed (yes/no)	*VS5P*	*VS5C*
Becomes excited when confronted with a variety of visual stimuli	*VS6P*	*VS6C*
Has trouble judging stairs, heights	*VS7P*	*VS7C*
Enjoys visual patterns	*VS8P*	*VS8C*
Upset by things in environment looking different	*VS9P*	*VS9C*
Makes decisions about food, clothing, objects by sight	*VS10P*	*VS10C*
Arranges environment in certain ways and can tell if out of order	*VS11P*	*VS11C*
Closely examines objects or hands	*VS12P*	*VS12C*
Depth perception problems	*VS13P*	*VS13C*

SENSORY CONCERNS

Olfactory Sensitivity: ***OS***

Reacts negatively to certain smells	*OS1P*	*OS1C*
Smells objects, food, people	*OS2P*	*OS2C*
Explores environment by smelling	*OS3P*	*OS3C*

Ellis Functional Assessment **Page 6**

Ratings---Please rate from 0 to 10 on the characteristics listed below
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Auditory Processing: *AP*	**In the Past**	**Currently**
Has been diagnosed with hearing problem at some time	*AP1P*	*AP1C*
Overreact to unexpected sounds	*AP2P*	*AP2C*
Fearful of some noises - list	*AP3P*	*AP3C*
Over-sensitive to sounds	*AP4P*	*AP4C*
Distracted by certain sounds	*AP5P*	*AP5C*
Confused about direction of sounds	*AP6P*	*AP6C*
Likes sounds that are constant and mask outside sounds	*AP7P*	*AP7C*
Becomes easily frustrated / sleeps with high noise level (circle)	*AP8P*	*AP8C*

AP8 *AP9* *AP9P* *AP9C*

Tactile Defensiveness: *TD*		
Does not respond appropriately to temperature or pain	*TD1P*	*TD1C*
Is defensive to the touch of others	*TD2P*	*TD2C*
Prefers deep touching rather than soft	*TD3P*	*TD3C*
Has to know that someone is going to touch ahead of time	*TD4P*	*TD4C*
Only wants hugs or cuddling when self-initiated	*TD5P*	*TD5C*
Explores environment by touching	*TD6P*	*TD6C*
Becomes irritated if bumped or touched by others	*TD7P*	*TD7C*
Misinterprets touches from others	*TD8P*	*TD8C*
Dislikes the feel of certain clothing	*TD9P*	*TD9C*
Dislikes the feel of labels on clothing	*TD10P*	*TD10C*
Is sensitive to certain clothing	*TD11P*	*TD11C*
Refuses to touch certain things	*TD12P*	*TD12C*
Doesn't like showers	*TD13P*	*TD13C*
Wants to play in water for long periods of time	*TD14P*	*TD14C*
Mouths (sucks) on objects or clothing	*TD15P*	*TD15C*
Dislikes the touch of certain surfaces	*TD16P*	*TD16C*
Dislikes having hair, face, or mouth touched	*TD17P*	*TD17C*
Upset by sticky, gooey hands	*TD18P*	*TD18C*

Movement/Vestibular: *MV*		
Seems fearful in open spaces	*MV1P*	*MV1C*
Spins or whirls self around	*MV2P*	*MV2C*
Likes rocking, swinging, spinning (circle which)	*MV3P*	*MV3C*
Walks on toes	*MV4P*	*MV4C*
Appears clumsy	*MV5P*	*MV5C*
Climbs a lot, difficult with balancing activities	*MV6P*	*MV6C*

Taste Concerns: *TC*		
Dislikes certain foods/textures	*TC1P*	*TC1C*
Will only eat a small variety of foods	*TC2P*	*TC2C*
Tastes non-edible objects	*TC3P*	*TC3C*
Explores environment by tasting	*TC4P*	*TC4C*

Ellis Functional Assessment **Page 7**

Ratings---Please rate from 0 to 10 on the characteristics listed below
0 = No Problems/Difficulty, 5 = Moderate Problems/Difficulty, 10 = Severe Problems/Difficulty

Perceptual/Perceptual Motor: ***PPM***	**In the Past**	**Currently**
Has trouble with paper/pencil activities	*PPM1P*	*PPM1C*
Difficulty with body in space	*PPM2P*	*PPM2C*
Problems organizing materials and moving them appropriately	*PPM3P*	*PPM3C*
Distracted by door, cupboards being open, holes or motion	*PPM4P*	*PPM4C*
Difficulty copying	*PPM5P*	*PPM5C*
Difficulty judging distance	*PPM6P*	*PPM6C*
Difficulty throwing objects	*PPM7P*	*PPM7C*

Personal Management/Self Control: ***PMSC***		
Difficulty waiting	*PMSC1P*	*PMSC1C*
Difficulty finishing work	*PMSC2P*	*PMSC2C*
Problem taking care of personal and school belongings	*PMSC3P*	*PMSC3C*
Difficulty being quiet when required	*PMSC4P*	*PMSC4C*
Difficulty talking when spoken to, especially if asked a question	*PMSC5P*	*PMSC5C*
Difficulty working independently without bothering others	*PMSC6P*	*PMSC6C*
Not being prepared and organized for activities and lessons	*PMSC7P*	*PMSC7C*
Not turning in assignments on time	*PMSC8P*	*PMSC8C*
Changing activities	*PMSC9P*	*PMSC9C*
Accepting correction	*PMSC10P*	*PMSC10C*
Accepting that mistakes can be fixed	*PMSC11P*	*PMSC11C*

Difficulty Understanding The Specific Behaviors Required For The Following Concepts: ***DUSB***		
Doing one's best	*DUSB1P*	*DUSB1C*
Caring	*DUSB2P*	*DUSB2C*
Being kind to others	*DUSB3P*	*DUSB3C*
Being good	*DUSB4P*	*DUSB4C*
Being polite	*DUSB5P*	*DUSB5C*
Humor	*DUSB6P*	*DUSB6C*

Health Or Physical Concerns: ***HPC***		
History of eating problems	*HPC1P*	*HPC1C*
History of sleeping problems	*HPC2P*	*HPC2C*
Negative reaction when tired	*HPC3P*	*HPC3C*
Exaggerated reaction when sick	*HPC4P*	*HPC4C*
Increase in negative behaviors when hungry	*HPC5P*	*HPC5C*
Stomach problems	*HPC6P*	*HPC6C*
Skin problems	*HPC7P*	*HPC7C*

Ellis Functional Assessment **Page 8**

Ratings---Please rate from 0 to 10 on the characteristics listed below
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Negative Reactions to Discipline:	***NRTD***	**In the Past**	**Currently**
Does not like being corrected		*NRTD1P*	*NRTD1C*
Will not come when called to a group		*NRTD2P*	*NRTD2C*
Will not stay in certain places		*NRTD3P*	*NRTD3C*
Reacts negatively to being scolded		*NRTD4P*	*NRTD4C*
Refuses to pick up, clean up, straighten up		*NRTD5P*	*NRTD5C*
Will not put away belongings		*NRTD6P*	*NRTD6C*
Will not get out of an area when requested		*NRTD7P*	*NRTD7C*
Will not walk or stand still when requested		*NRTD8P*	*NRTD8C*
Significant difficulty waiting		*NRTD9P*	*NRTD9C*
Reacts in a negative way to being denied		*NRTD10P*	*NRTD10C*
Reacts negatively when others are late		*NRTD11P*	*NRTD11C*

Yes or No response required of condition, but 0 – 3 for behaviors below.

Previously Diagnosed With Any Of The Following:	***PD****	**In the Past**	**Currently**
Bipolar Disorder		*PD1PNY*	*PD1CNY*
Gifted		*PD2PNY*	*PD2CNY*
Tourette's Syndrome		*PD3PNY*	*PD3CNY*
Obsessive Compulsive Disorder		*PD4PNY*	*PD4CNY*
Oppositional Defiant Disorder		*PD5PNY*	*PD5CNY*
Depression (Dysthymia)		*PD6PNY*	*PD6CNY*
Learning Disabled		*PD7PNY*	*PD7CNY*
Mentally Retarded		*PD8PNY*	*PD8CNY*
Vocal tics (making self-induced noises)		*PD9PNY*	*PD9CNY*
Conduct Disorder (rate behaviors below 0-3)			
Aggression toward others – (circle which)		*PD10P*	*PD10C*
Biting (*PD11PNY, PD11CNY*), hitting (*PD12PNY, PD12CNY*),kicking (*PD1 PD13NY*), pinching (*PN14PNY, PD14CNY*)			
Self-injurious behaviors – (circle which)		*PD15P*	*PD15C*
Temper tantrums		*PD16PNY*	*PD16CNY*
Screaming, yelling		*PD17PNY*	*PD17CNY*
Non-compliance and refusal to move, to do things		*PD18PNY*	*PD18CNY*
ADHD (rate behaviors below 0-3)		*PD19PNY*	*PD19CNY*
Hyperactivity		*PD20P*	*PD20C*
Short attention span to some activities and not to others		*PD21P*	*PD21C*
Impulsivity		*PD22P*	*PD22C*
Delayed response time		*PD23P*	*PD23C*

*NY in variable name denotes a dichotomous variable.

APPENDIX C

Item Elimination from Ellis Functional Assessment for Preliminary Factor Analysis

Ellis Functional Assessment

NAME:_____ **DATE:**_____

COMPLETED BY:_____

Ratings---Please rate from 0 to 10 on the characteristics listed below
0 = No Problems/Difficulty, 5 = Moderate Problems/Difficulty, 10 = Severe Problems/Difficulty

Problems With Social Interaction: *PCI*	**In the Past**	**Currently**
Wanting and needing to be left alone at times	*PCI1P*	*PCI1C*
Trouble with back and forth social interactions		*PCI2C*
Inability to respond to social cues		*PCI3C*
Inability to understand how someone else might feel		*PCI4C*
Inappropriate giggling or laughing		*PCI5C*
Impaired imitation – not engaging in simple games of childhood		*PCI6C*
Lack of socially directed smiles		*PCI7C*
Asks a lot of questions as a way of interacting		*PCI8C*
Inappropriately intrusive in social situations		*PCI9C*
Mimicking actions from TV, but won't interact		
Problems when not first or doesn't win		*PCI11C*

Difficulties With Nonverbal Interaction: *DNI*		
Not accepting cuddling, hugging, touching unless self-initiated		
Gets in other's space		*DNI2C*
No eye contact or stares at the wrong time (circle which)		*DNI3C*
Difficulty with non-verbal gestures (too little or too much)		*DNI4C*
Problems with eye to eye contact		*DNI5C*
Difficulty looking at person talking appropriately		*DNI6C*
Difficulty making appropriate facial expressions		*DNI7C*
Awkward body postures		*DNI8C*
Appears to be stiff	*DNI9P*	*DNI9C*
Lacks hand gestures	*DNI10P*	*DNI10C*

Problems sharing Enjoyment, Interests, Or Achievements With Others: *PSE*		
Difficulty sharing in excitement of others	*PSE1P*	*PSE1C*
Difficulty sharing in enjoyment of others	*PSE2P*	*PSE2C*
Difficulty sharing in the interests of others	*PSE3P*	*PSE3C*
Difficulty sharing in the achievements of others	*PSE4P*	*PSE4C*
Difficulty showing others objects of interest	*PSE5P*	*PSE5C*
Inability to bring objects of interest to others	*PSE6P*	*PSE6C*
Difficulty pointing out objects of interests to others	*PSE7P*	*PSE7C*

Ellis Functional Assessment **Page 2**

Ratings---Please rate from 0 to 10 on the characteristics listed below
0 = No Problems/Difficulty, 5 = Moderate Problems/Difficulty, 10 = Severe Problems/Difficulty

Difficulties Interacting with Friends or Others: *DIF*	**In the Past**	**Currently**
Overreact/difficulty with bullying		*DIF1C*
Overreact/difficulty with being teased		*DIF2C*
Does not like being left out		*DIF3C*
Reacts negatively when interrupted		*DIF4C*
Experiences difficulty when ignored		*DIF5C*
Fears losing people who are valuable		*DIF6C*
Difficulty listening at an appropriate level		
Makes inappropriate comments		*DIF8C*
When answering questions may be off the topic	*DIF9P*	*DIF9C*
Says yes/no – just to get someone off his or her back		
Difficulty accepting help from others		
Accepting that some request cannot be complied with		*DIF12C*
Inability to make choices		
Obsessed with specific friends (that may not like him or her)		*DIF14C*
Does not understand the concept of being polite	*DIF15P*	*DIF15C*
Does not understand the concept of being kind	*DIF16P*	*DIF16C*
Does not understand the concept of being considerate	*DIF17P*	*DIF17C*
Difficulties with tattling – too little or too much (circle which)		*DIF18C*
Honest to a fault		
Will not walk away while someone is talking		*DIF20C*
Will not stay an appropriate distance from a person		*DIF21C*
Difficulty being fair (will argue a point)		*DIF22C*
Difficulty making friends		*DIF23C*

Unusual, Restricted, And Repetitive Patterns Of Behavior, Interests, & Activities: ***URRB***

Will watch videos or video segments over and over	*URRB1P*	
Will play video or computer games for extended periods	*URRB2P*	
Will play Pokémon or similar games for extended periods of time	*URRB3P*	
Will line up and/or ordering objects	*URRB4P*	
Strong attachment to objects – list:	*URRB5P*	
Fascination with movement (spinning wheels, fans door, drawers)	*URRB6P*	*URRB6C*
Pacing, running back and forth or running round and round	*URRB7P*	
Licking, smelling, touching things around him/her	*URRB8P*	
Insistence on routines, resisting change	*URRB9P*	*URRB9C*
Negative reaction to change in environment	*URRB10P*	
Perfectionist, problems with correction or "mistakes"	*URRB11P*	*URRB11C*
Difficulty with unstructured time	*URRB12P*	
Staring at patterns, lights, or shiny surfaces	*URRB13P*	*URRB13C*
Lack of fear of real danger	*URRB14P*	
Excessive fearfulness of some harmless objects or situations	*URRB15P*	*URRB15C*
Obsessive cleaning	*URRB16P*	
Obsessed with "bad words"	*URRB17P*	
Moves parts of body a great deal	*URRB18P*	
Overreacts to possible loss of pet(s)	*URRB19P*	
Worries about losing things of value	*URRB20P*	

Ellis Functional Assessment **Page 3**

Ratings---Please rate from 0 to 10 on the characteristics listed below
0 = No Problems/Difficulty, 5 = Moderate Problems/Difficulty, 10 = Severe Problems/Difficulty

A Lack Of Social Or Emotional Back and Forth Interaction: *LSEI* In the Past Currently

Difficulty imitating modeled behaviors	*LSEI1P*	*LSEI1C*
Difficulty sharing with others	*LSEI2P*	*LSEI2C*
Problems taking turns	*LSEI3P*	*LSEI3C*
Difficulty sitting and participating in groups	*LSEI4P*	*LSEI4C*
Inability to negotiate with others	*LSEI5P*	*LSEI5C*
Difficulty initiating social interactions	*LSEI6P*	*LSEI6C*
Difficulty engaging in appropriate play with others	*LSEI7P*	*LSEI7C*
Inappropriate or no greeting of others	*LSEI8P*	*LSEI8C*
Difficulty or inappropriate complimenting	*LSEI9P*	*LSEI9C*
Difficulty or inappropriate offering of help, comfort	*LSEI10P*	*LSEI10C*
Difficulty asking for help, or seeking comfort	*LSEI11P*	*LSEI11C*
Difficulty inviting others to join in	*LSEI12P*	*LSEI12C*
Problems asking for feedback or inappropriate requests for praise	*LSEI13P*	*LSEI13C*
Difficulty asking for an appropriate favor	*LSEI14P*	*LSEI14C*
Inability to engage in social chat	*LSEI15P*	*LSEI15C*
Problems getting attention in appropriate way, raising hand, waiting	*LSEI16P*	*LSEI16C*
Inappropriate display of caring when someone is hurt or sick	*LSEI17P*	*LSEI17C*
Difficulty letting someone know that he or she is hurt or sick	*LSEI18P*	*LSEI18C*
Problems asking someone to play or do an activity	*LSEI19P*	
Difficulty participating in groups		*LSEI20C*
Problems following group rules		*LSEI21C*
Difficulty taking his or her turn		*LSEI22C*
Difficulty dealing with the concept of majority rules		*LSEI23C*
Problems with winning and losing		*LSEI24C*
Inappropriate response to misfortune of others-laughing-ignoring		

Academic Concerns: ***AC***

Uneven profile of skills (Verbal vs. Nonverbal skills)	*AC1P*	*AC1C*
Well-developed long term memory vs. poor short term memory	*AC2P*	
Over or under generalization of learning	*AC3P*	*AC3C*
Good visual skills	*AC4P*	
Problems organizing	*AC5P*	
Needs help to problem solve	*AC6P*	*AC6C*
Taking too long to complete task	*AC7P*	
Difficulty starting tasks	*AC8P*	*AC8C*
Difficulty organizing tasks	*AC9P*	*AC9C*

Ellis Functional Assessment **Page 4**

Ratings---Please rate from 0 to 10 on the characteristics listed below
0 = No Problems/Difficulty, 5 = Moderate Problems/Difficulty, 10 = Severe Problems/Difficulty

Qualitative Impairments In Communication: *QIC*	**In the Past**	**Currently**
Problems with pronouns (I, you, he/she)		*QIC1C*
Problems with work order		*QIC2C*
Problems answering questions		
Problems responding to directions		*QIC4C*
Problems understanding jokes		*QIC5C*
Problems understanding multiple meaning of words		*QIC6C*
Problems understanding sarcasm, idioms, and figures of speech		*QIC7C*
Echoing what is said directly, later, or in a slightly changed way		
Uses the phrases from videos or songs in a speech		*QIC9C*
Rarely initiates communication	*QIC10P*	*QIC10C*
Always initiating conversation on the area of interest		
Difficulty understanding abstract concepts		
Difficulty with vague concepts		
Difficulty with long sentences		*QIC14C*
Difficultly when someone is speaking too fast		*QIC15C*
Problems with reciprocal conversations		*QIC16C*
Problems with speech (monotone, lack of emotion)		*QIC17C*
Difficulty being understood		
Difficulty understanding		*QIC19C*
Problems with not having enough information		*QIC20C*
Problems when not given choices		*QIC21C*

Major Changes In Environment That Cause Problems: *MCE*		
Reacts negatively to alterations in school schedule		*MCE1C*
Problems with changes in school personnel		*MCE2C*
Problems with changes in transportation routines		*MCE3C*
Difficulties with changes at work		
Problems with the schedule changes in the home		*MCE5C*
Difficulties with activity location changes		*MCE6C*
Problems when friend or classmate is absent		*MCE7C*
Difficulties when family member or friend is late or not coming		*MCE8C*
Overreact when anticipating an event or activity		
Difficulties when there is cancellation of an event or activity		
Reacts negatively to having to wait too long		
Wants to wear the same clothing despite changes in weather		

Ellis Functional Assessment **Page 5**

Ratings---Please rate from 0 to 10 on the characteristics listed below
0 = No Problems/Difficulty, 5 = Moderate Problems/Difficulty, 10 = Severe Problems/Difficulty

Possible Motor Problems:	***PMP***	**In the Past**	**Currently**
Clumsiness		*PMP1P*	
Difficulty with balance		*PMP2P*	*PMP2C*
Difficulty riding a bicycle		*PMP3P*	*PMP3C*
Stiffness muscle – diagnosed physical problem (yes/no)		*PMP4P*	
Motor planning – can't seem to make the body do what it needs to do		*PMP5P*	
Motor fatigue – tired easily		*PMP6P*	*PMP6C*
Lack of muscle strength		*PMP7P*	
Perceptual motor, spacing, sequencing, printing, writing (circle)		*PMP8P*	
Ability to manipulate items better than paper-pencil abilities		*PMP9P*	

Environmental Confusion: ***EC***

Problems in crowds	*EC1P*	*EC1C*
Difficultly when surrounded by too much movement	*EC2P*	*EC2C*
Difficulty when surrounded by competing visual stimuli	*EC3P*	*EC3C*
Difficulty not having enough space	*EC4P*	*EC4C*
Being off the pace of others	*EC5P*	*EC5C*

Visual Sensitivity: ***VS***

Has been diagnosed with a visual problem	*VS1P*	*VS1C*
Is sensitive to light	*VS2P*	
Is distracted by visual stimuli	*VS3P*	
Enjoys watching moving things/bright objects	*VS4P*	
Has visual tracking problem – diagnosed (yes/no)	*VS5P*	
Becomes excited when confronted with a variety of visual stimuli		*VS6C*
Has trouble judging stairs, heights	*VS7P*	*VS7C*
Enjoys visual patterns	*VS8P*	*VS8C*
Upset by things in environment looking different	*VS9P*	*VS9C*
Makes decisions about food, clothing, objects by sight	*VS10P*	*VS10C*
Arranges environment in certain ways and can tell if out of order	*VS11P*	*VS11C*
Closely examines objects or hands	*VS12P*	*VS12C*
Depth perception problems	*VS13P*	

SENSORY CONCERNS

Olfactory Sensitivity: ***OS***

Reacts negatively to certain smells	*OS1P*	*OS1C*
Smells objects, food, people	*OS2P*	*OS2C*
Explores environment by smelling	*OS3P*	*OS3C*

Ellis Functional Assessment **Page 6**

Ratings---Please rate from 0 to 10 on the characteristics listed below
0 = No Problems/Difficulty, 5 = Moderate Problems/Difficulty, 10 = Severe Problems/Difficulty

Auditory Processing: *AP*	**In the Past**	**Currently**
Has been diagnosed with hearing problem at some time	*AP1P*	*AP1C*
Overreact to unexpected sounds	*AP2P*	*AP2C*
Fearful of some noises - list	*AP3P*	*AP3C*
Over-sensitive to sounds	*AP4P*	*AP4C*
Distracted by certain sounds	*AP5P*	*AP5C*
Confused about direction of sounds	*AP6P*	*AP6C*
Likes sounds that are constant and mask outside sounds	*AP7P*	*AP7C*
Becomes easily frustrated / sleeps with high noise level (circle)	*AP8P*	*AP8C*
AP9	*AP9P*	*AP9C*

Tactile Defensiveness: *TD*		
Does not respond appropriately to temperature or pain	*TD1P*	*TD1C*
Is defensive to the touch of others		*TD2C*
Prefers deep touching rather than soft	*TD3P*	*TD3C*
Has to know that someone is going to touch ahead of time		*TD4C*
Only wants hugs or cuddling when self-initiated		*TD5C*
Explores environment by touching		*TD6C*
Becomes irritated if bumped or touched by others		*TD7C*
Misinterprets touches from others		*TD8C*
Dislikes the feel of certain clothing		*TD9C*
Dislikes the feel of labels on clothing		*TD10C*
Is sensitive to certain clothing		*TD11C*
Refuses to touch certain things		*TD12C*
Doesn't like showers		
Wants to play in water for long periods of time		
Mouths (sucks) on objects or clothing		
Dislikes the touch of certain surfaces		*TD16C*
Dislikes having hair, face, or mouth touched		*TD17C*
Upset by sticky, gooey hands	*TD18P*	*TD18C*

Movement/Vestibular: *MV*		
Seems fearful in open spaces	*MV1P*	
Spins or whirls self around	*MV2P*	*MV2C*
Likes rocking, swinging, spinning (circle which)	*MV3P*	
Walks on toes	*MV4P*	*MV4C*
Appears clumsy	*MV5P*	*MV5C*
Climbs a lot, difficult with balancing activities	*MV6P*	*MV6C*

Taste Concerns: *TC*		
Dislikes certain foods/textures	*TC1P*	*TC1C*
Will only eat a small variety of foods	*TC2P*	
Tastes non-edible objects	*TC3P*	
Explores environment by tasting	*TC4P*	

Ellis Functional Assessment **Page 7**

Ratings---Please rate from 0 to 10 on the characteristics listed below
0 = No Problems/Difficulty, 5 = Moderate Problems/Difficulty, 10 = Severe Problems/Difficulty

Perceptual/Perceptual Motor:	***PPM***	**In the Past**	**Currently**
Has trouble with paper/pencil activities			
Difficulty with body in space			*PPM2C*
Problems organizing materials and moving them appropriately			
Distracted by door, cupboards being open, holes or motion			*PPM4C*
Difficulty copying			
Difficulty judging distance			
Difficulty throwing objects			

Personal Management/Self Control:	***PMSC***		
Difficulty waiting			
Difficulty finishing work			*PMSC2C*
Problem taking care of personal and school belongings			
Difficulty being quiet when required			
Difficulty talking when spoken to, especially if asked a question			
Difficulty working independently without bothering others			
Not being prepared and organized for activities and lessons			*PMSC7C*
Not turning in assignments on time			*PMSC8C*
Changing activities			
Accepting correction			*PMSC10C*
Accepting that mistakes can be fixed			

Difficulty Understanding The Specific Behaviors Required For The Following Concepts:	***DUSB***	
Doing one's best		*DUSB1C*
Caring		*DUSB2C*
Being kind to others		*DUSB3C*
Being good		*DUSB4C*
Being polite		*DUSB5C*
Humor		*DUSB6C*

Health Or Physical Concerns:	***HPC***	
History of eating problems		*HPC1C*
History of sleeping problems		*HPC2C*
Negative reaction when tired		*HPC3C*
Exaggerated reaction when sick		*HPC4C*
Increase in negative behaviors when hungry		*HPC5C*
Stomach problems		
Skin problems	*HPC7P*	*HPC7C*

Ellis Functional Assessment **Page 8**

Ratings---Please rate from 0 to 10 on the characteristics listed below
0 = No Problems/Difficulty, 5 = Moderate Problems/Difficulty,
10 = Severe Problems/Difficulty

Negative Reactions to Discipline:	***NRTD***	**In the Past**	**Currently**
Does not like being corrected			
Will not come when called to a group			*NRTD2C*
Will not stay in certain places			*NRTD3C*
Reacts negatively to being scolded			*NRTD4C*
Refuses to pick up, clean up, straighten up			*NRTD5C*
Will not put away belongings			*NRTD6C*
Will not get out of an area when requested			*NRTD7C*
Will not walk or stand still when requested			*NRTD8C*
Significant difficulty waiting			*NRTD9C*
Reacts in a negative way to being denied			*NRTD10C*
Reacts negatively when others are late			

Yes or No response required of condition, but 0 – 3 for behaviors below.

Previously Diagnosed With Any Of The Following:	***PD****	**In the Past**	**Currently**
Bipolar Disorder			
Gifted			
Tourette's Syndrome			
Obsessive Compulsive Disorder			
Oppositional Defiant Disorder			
Depression (Dysthymia)			
Learning Disabled			
Mentally Retarded			
Vocal tics (making self-induced noises)			
Conduct Disorder (rate behaviors below 0-3)			
Aggression toward others – (circle which)		*PD10P*	*PD10C*
Biting (*PD11PNY, PD11CNY*), hitting (*PD12PNY, PD12CNY*), kicking (*PD13PNY,* *PD13NY*), pinching (*PN14PNY, PD14CNY*)			
Self-injurious behaviors – (circle which)		*PD15P*	
Temper tantrums		*PD16PNY*	*PD16CNY*
Screaming, yelling		*PD17PNY*	*PD17CNY*
Non-compliance and refusal to move, to do things		*PD18PNY*	*PD18CNY*
ADHD (rate behaviors below 0-3)		*PD19PNY*	*PD19CNY*
Hyperactivity		*PD20P*	
Short attention span to some activities and not to others		*PD21P*	*PD21C*
Impulsivity		*PD22P*	*PD22C*
Delayed response time		*PD23P*	

*NY in variable name denotes a dichotomous variable.

APPENDIX D

Autism Assessment Scale for Children
Parent/Guardian Form

STUDENT NAME:_____ **DATE:**_____

COMPLETED BY:_____

The Autism Assessment Scale for Children contains a series of statements for you to rate your child's behavior on a scale from 0 to 10. A score of 0 represents no problems or difficulties with this characteristic, a score of 5 represents moderate problems, and a score of 10 represents severe problems. Please rate these statements to reflect your child's behaviors both in the past and currently. Past behavior includes behavior that occurred at any point in this child's development prior to this school year. Current behavior includes behavior that has occurred during the current school year.

Ratings—Please rate from 0 to 10 on the characteristics listed below
0 = No Problems/Difficulty, 5 = Moderate Problems/Difficulty, 10 = Severe Problems/Difficulty

Child Characteristic	In the Past	Current
Will not stay an appropriate distance from a person		
Difficulty being fair (will argue a point)		
Problems following group rules		
Difficulty taking his or her turn		
Difficulty or inappropriate complimenting		
Difficulty or inappropriate offering of help, comfort		
Problems asking for feedback or inappropriate requests for praise		
Problems asking someone to play or do an activity		
Doesn't understand the concept of being polite		
Doesn't understand the concept of being kind		
Doesn't understand the concept of being considerate		
Problems in crowds		
Is sensitive to light		
Over-sensitive to sounds		
Dislikes the feel of certain clothing		
Needs help to problem solve		
Problems understanding jokes		
Difficulty when someone is speaking too fast		
Problems with reciprocal conversations		

Autism Assessment Scale for Children
Teacher/Educator Form

CHILD NAME:_____ **DATE:**_____

COMPLETED BY:_____

The Autism Assessment Scale for Children contains a series of statements for you to rate a child's behavior on a scale from 0 to 10. A score of 0 represents no problems or difficulties with this characteristic, a score of 5 represents moderate problems, and a score of 10 represents severe problems. Please rate these statements to reflect this child's behavior during the current school year.

Ratings---Please rate from 0 to 10 on the characteristics listed below
0 = No Problems/Difficulty, 5 = Moderate Problems/Difficulty, 10 = Severe Problems/Difficulty

Student Characteristic	
Will not stay an appropriate distance from a person	
Difficulty being fair (will argue a point)	
Problems following group rules	
Difficulty taking his or her turn	
Difficulty or inappropriate complimenting	
Difficulty or inappropriate offering of help, comfort	
Problems asking for feedback or inappropriate requests for praise	
Problems asking someone to play or do an activity	
Doesn't understand the concept of being polite	
Doesn't understand the concept of being kind	
Doesn't understand the concept of being considerate	
Problems in crowds	
Is sensitive to light	
Over-sensitive to sounds	
Dislikes the feel of certain clothing	
Needs help to problem solve	
Problems understanding jokes	
Difficulty when someone is speaking too fast	
Problems with reciprocal conversations	

APPENDIX E

IRB Approval Letter and Application

OLD DOMINION UNIVERSITY

DARDEN COLLEGE OF EDUCATION
Human Subject Committee
Norfolk, Virginia 23529-0156
Phone (757) 683-4695
Fax (757) 683-3756

April 11, 2014 Approved Application Number: 201401105

Dr. Jennifer Kidd
Department of Teaching and Learning

Dear Dr. Kidd:

Your Application for Exempt Research with Christine Hebert entitled "Developing a DSM-V Pre-screening Questionnaire for Mild Autism for Use in Schools" has been found to be EXEMPT under Category 6.4 from IRB review by the Human Subjects Review Committee of the Darden College of Education.

The determination that this study is EXEMPT from IRB review is for an indefinite period of time provided no significant changes are made to your study. If any significant changes occur, notify me or the chair of this committee at that time and provide complete information regarding such changes. In the future, if this research project is funded externally, you must submit an application to the University IRB for approval to continue the study.

Best wishes in completing your study.

Sincerely,

Theodore P. Remley, Jr., J.D., Ph.D.
Professor and Batten Endowed Chair in Counseling
Department of Counseling and Human Services
ED 110
Norfolk, VA 23529
tremley@odu.edu

Chair
Darden College of Education Human Subjects Review Committee
Old Dominion University

OLD DOMINION UNIVERSITY
APPLICATION FOR EXEMPT RESEARCH

Note: For research projects regulated by or supported by the Federal Government, submit 10 copies of this application to the Institutional Review Board. Otherwise, submit to your college human subjects committee.

Responsible Project Investigator (RPI) The RPI must be a member of ODU faculty or staff who will serve as the project supervisor and be held accountable for all aspects of the project. Students cannot be listed as RPI.		
First Name: Jennifer	**Middle Initial:**	**Last Name: Kidd**
Telephone: 757-683-3248	**Fax Number:**	**E-mail: jkidd@odu.edu**
Office Address: Education Building, Room 167		
City: Norfolk	**State: Virginia**	**Zip: 23508**
Department: Teaching and Learning	**College: Darden College of Education**	
Complete Title of Research Project: Does Universal Acceleration Narrow the Achievement Gap?: An Analysis of One School System's Curriculum		**Code Name (One word): Acceleration**
Investigators [illegible]		
First Name: Christine	**Middle Initial: L**	**Last Name: Hebert**
Telephone: 757-646-3012	**Fax Number:**	**Email: chebe008@odu.edu**
Office Address: Education Building, Room 215		
City: Norfolk	**State: Virginia**	**Zip: 23508**
Affiliation: __Faculty _X_Graduate Student __ Undergraduate Student __Staff __Other_____		
First Name:	**Middle Initial:**	**Last Name:**
Telephone:	**Fax Number:**	**Email:**
Office Address:		
City:	**State:**	**Zip:**
Affiliation: __Faculty __Graduate Student __ Undergraduate Student __Staff __Other_____		
List additional investigators on attachment and check here: __		

Type of Research
1. This study is being conducted as part of (check all that apply):
_ Faculty Research _ Non-Thesis Graduate Student

	Research		
X	Doctoral Dissertation Project	_	Honors or Individual Problems
_	Master's Thesis	_	Other_____

Funding

2. Is this research project externally funded or contracted for by an agency or institution which is independent of the university? Remember, if the project receives ANY federal support, then the project CANNOT be reviewed by a College Committee and MUST be reviewed by the University's Institutional Review Board (IRB).

___Yes **(If yes, indicate the granting or contracting agency and provide identifying information.)**
_X__No

Agency Name:
Mailing Address:
Point of Contact:
Telephone:

Research Dates

1. This study is being conducted as part of (check all that apply):

_	Faculty Research Research	_	Non-Thesis Graduate Student
X	Doctoral Dissertation Project	_	Honors or Individual Problems
_	Master's Thesis	_	Other_____

Funding

2. Is this research project externally funded or contracted for by an agency or institution which is independent of the university? Remember, if the project receives ANY federal support, then the project CANNOT be reviewed by a College Committee and MUST be reviewed by the University's Institutional Review Board (IRB).

___Yes **(If yes, indicate the granting or contracting agency and provide identifying information.)**
_X__No

Agency Name:
Mailing Address:
Point of Contact:
Telephone:

5. Attach a description of the following items:

__Description of the Proposed Study
__Research Protocol
__References
__Any Letters, Flyers, Questionnaires, etc. which will be distributed to the study subjects or other study participants
_X_If the research is part of a research proposal submitted for federal, state or external funding, submit a copy of the FULL proposal

Note: The description should be in sufficient detail to allow the Human Subjects Review Committee to determine if the study can be classified as EXEMPT under Federal Regulations 45CFR46.101(b).

Exemption categories

6. Identify which of the 6 federal exemption categories below applies to your research proposal and explain

why the proposed research meets the category. Federal law 45 CFR 46.101(b) identifies the following EXEMPT categories. Check all that apply and provide comments.

SPECIAL NOTE: The exemptions at 45 CFR 46.101(b) do not apply to research involving prisoners, fetuses, pregnant women, or human in vitro fertilization. The exemption at 45 CFR 46.101(b)(2), for research involving survey or interview procedures or observation of public behavior, does not apply to research with children, except for research involving observations of public behavior when the investigator(s) do not participate in the activities being observed.

____(6.1) Research conducted in established or commonly accepted educational settings, involving normal educational practices, such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.
Comments:

____(6.2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) Information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; AND (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk

of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.
Comments:

____(6.3) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior that is not exempt under paragraph (b)(2) of this section, if:
(i) The human subjects are elected or appointed public officials or candidates for public office; or (ii) federal statute(s) require(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter.
Comments:

_X_(6.4) Research, involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available or if the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects.
Comments:

The data bank of the Virginia Beach City Public Schools will be used for this study. No identifying information will be included in the records analyzed.

___ (6.5) Does not apply to the university setting; do not use it

____(6.6) Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the Food and Drug Administration or approved by the Environmental Protection Agency or the Food Safety and Inspection Service of the U.S. Department of Agriculture.
Comments:

Human Subjects Training

7. All investigators (including graduate students enrolled in Thesis and Dissertation projects involving human subjects) must document completion of the CITI Human Subject Protection course.
(Attach a copy of all CITI Human Subject Protection completion certificates.)
Date RPI completed Human Subject Protection training:__06/13/2011__

PLEASE NOTE:

You may begin research when the College Committee or Institutional Review Board gives notice of its approval.

You MUST inform the College Committee or Institutional Review Board of ANY changes in method or procedure that may conceivably alter the exempt status of the project.

Responsible Project Investigator (Must be original

CITI Collaborative Institutional Training Initiative

Social & Behavioral Research - Basic/Refresher Curriculum Completion Report
Printed on 6/18/2013

Learner: Christine Hebert (username: chebe008)
Institution: Old Dominion University
Contact Information Department: Educational Foundation and leadership
Email: celts1@cox.net

Social & Behavioral Research - Basic/Refresher: Choose this group to satisfy CITI training requirements for Investigators and staff involved primarily in Social/Behavioral Research with human subjects.

Stage 2. SBR 101 refresher Passed on 06/18/13 (Ref # 9419525)

Required Modules	Date Completed	Score
SBE Refresher 1 – Defining Research with Human Subjects	06/18/13	2/2 (100%)
SBE Refresher 1 – Privacy and Confidentiality	06/18/13	2/2 (100%)
SBE Refresher 1 – Assessing Risk	06/18/13	1/2 (50%)
SBE Refresher 1 – Research with Children	06/18/13	2/2 (100%)
SBE Refresher 1 – International Research	06/18/13	1/2 (50%)
SBE Refresher 1 – History and Ethical Principles	06/18/13	1/2 (50%)
SBE Refresher 1 – Federal Regulations for Protecting Research Subjects	06/18/13	2/2 (100%)
SBE Refresher 1 – Informed Consent	06/18/13	2/2 (100%)
SBE Refresher 1 – Research with Prisoners	06/18/13	2/2 (100%)

SBE Refresher 1 – Research in Educational Settings	06/18/13	2/2 (100%)
SBE Refresher 1 – Instructions	06/18/13	no quiz

For this Completion Report to be valid, the learner listed above must be affiliated with a CITI participating institution. Falsified information and unauthorized use of the CITI course site is unethical, and may be considered scientific misconduct by your institution.

Paul Braunschweiger Ph.D.
Professor, University of Miami
Director Office of Research Education
CITI Course Coordinator

VITAE

Christine Hebert

413 East Farmington Road
Virginia Beach, VA 23454
(757) 646-3012
Email: chebe008@odu.edu
Skype: christine.hebert8

Education

Old Dominion University, Norfolk, VA, Expected Graduation Date: 2014

Ph.D. in Curriculum and Instruction with a research Cognate
Dissertation: Developing a DSM-V Pre-screening Questionnaire for High-Functioning Autism for Use in Schools

Old Dominion University, Norfolk, VA, 1987

M.S. Ed in Mathematics Education; GPA: 4.0
Thesis: "Advanced Science Course Taking Patterns of Male and Female High School Calculus Students"

Towson State University: Towson, MD, 1975

B.A. in Mathematics
Minor: Computer Science

Graduation Magna Cum Laude

Honors and Awards

- Volunteers in Education Award from Old Donation Center 2014
- Awarded Graduate Student Travel Grant 2013
- Elected Treasurer of the ODU Graduate Student Organization 2012 - 2013
- Inducted into Kappa Delta Pi 1987
- Inducted into Phi Kappa Phi 1987

- Inducted into Golden Key International Honor Society 2011

Teaching Experience/College Level

Old Dominion University, Norfolk, VA

Instructor of Record TLED 301, TLED 360

Graduate Teaching Assistant 2011 - 2014

Education Courses TLED 479, TLED 301, TLED 360, TLED 478 Graded papers and provided requested assistance to instructor of record.

South University, Virginia Beach, VA

Adjunct Instructor – Mathematics 2010 - 2011

College Algebra and General Liberal Arts Mathematics

McNeese State University, Lake Charles, LA

Adjunct Instructor – Mathematics Department. 1980 - 1981

Remedial Mathematics, General Liberal Arts Mathematics and Calculus for Business Majors

Teaching Experience/K – 12

Virginia Beach City Schools, *Virginia Beach, VA* 1984 – 2011

First Colonial High School - Mathematics Teacher

I taught most of the mathematics curriculum with a special focus on Advanced Placement Calculus and Algebra II/Trig. I served on curriculum and textbook adoption committees. I chaired a textbook adoption committee. I served as the citywide coordinator for the Calculus Forum for a year. I sponsored the Key Club and Mu Alpha Theta. I also served on many building level committees including Civil Rights and Discipline.

Jefferson Davis Parish Schools, *Jennings, LA* 1981 - 1984

Fenton High School - Mathematics Teacher grades 9 – 12

Taught the entire high school mathematics curriculum in a K-12 rural school. Also served as mathematics coordinator for grades 1 – 8. Sponsored the Freshman Class, the Mathematics Club, and the Academic Competition Team.

Publications

Hebert C. L. & Kidd, J. (2014). Variables that affect minority students' decision to take advanced mathematics courses in high school. *Journal of Teaching and Learning.* Currently under review.

Hebert, C. L. (2013). Major Mathematics Education Reforms as Reflected in the 1969 and 2012 BC Advanced Placement Calculus Exams: A Comparison. *Virginia Mathematics Teacher (spring, 2013).*

Hebert, C. L. (2013). Book review of Sophie's Diary: A Mathematical Novel. *Mathematics Teacher* (Spring 2014).

Presentations

Hebert, C. L. (2014, March). Developing a DSM-V Pre-screening Questionnaire for Mild Autism for Use in Schools. *Graduate Achievement Day,* Norfolk, VA.

Hebert, C. L. (2014, March). Universal Acceleration: Bane or Blessing. *VCTM Conference Spring 2014,* Harrisonburg, VA.

Hebert, C. L. (2013, March). Teachers are the Solution: Successful Minority Students in the Advanced Mathematics Curriculum Speak. *VCTM Conference Spring 2013*, Virginia Beach, VA.

Hebert, C. L. (2013, April). Retention of minority students in an advanced mathematics curriculum in high school. *AERA Annual Conference 2013,* San Francisco, CA

Hebert, C. L. (2014, July). I'm an Aspie, What's Your Superpower? *2014 Mensa Annual Gathering,* Boston, MA.

Hebert, C. L. (2013, July). Asperger's Syndrome: Symptoms and Benefits. *2013 Mensa Annual Gathering.* Fort Worth, Texas.

Hebert, C.L. (2013, August). Asperger's Syndrome: Benefits. *Permean Basin Adults with Asperger's Support Group,* Madison Stroud, Texas

Professional Affiliations

- American Educational Research Association
- National Council of Teachers of Mathematics
- Virginia Council of Teachers of Mathematics

- Kappa Delta Pi
- Phi Kappa Phi
- Golden Key International Honor Society
- American Mensa, Ltd.

Service

- Served on panel discussion for undergraduate students on teaching in a K–12 environment. 2012
- Represented the Graduate Student Organization on a panel for foreign students 2012
- Evaluated English and teaching skills of foreign graduate students wishing to be teaching assistants 2012, 2013
- Graduate Student Organization Treasurer 2012-2013

Grants

- Graduate Student Travel Grant 2013