

RELATIONS BETWEEN AGE, AUTISM SEVERITY, BEHAVIORAL TREATMENT  
AND THE AMOUNT OF TIME IN REGULAR EDUCATION CLASSROOMS  
AMONG STUDENTS WITH AUTISM

A DISSERTATION

SUBMITTED TO THE GRADUATE SCHOOL

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR THE DEGREE

DOCTOR OF PHILOSOPHY

BY

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JULY 2012

## ACKNOWLEDGEMENTS

To Dr. Paulson, Dr. Pierson, Dr. Finch, Dr. McIntosh, and Dr. McCauliff...thank you for all of your guidance, and support. I know listening to my worries and ramblings could not have been easy. Yet, with an encouraging smile, and non-judgmental ear, you believed in me, listened to me and helped me stay on track. For that, I am forever grateful.

## DEDICATION

To my son Miles...you are the reason I wake up every morning; seeing your smile each morning reminds me that it is a new day, and it gives me courage to start again. You are my reason for being. I'm not sure I would have made it without you. It is only because of you that I decided to chase my dreams. Mommy is trying so hard to be a better person because of you. With your loving words, you've reassured me. I love you. You are my greatest blessing, my heart, and soul. Thank you for being the best son a mommy could ask for.

To my mom...thank you for believing in me when I didn't. I know none of this would have been possible without your love and support. You are my greatest inspiration, and my best friend. When I falter, I think of how you continued on, with such grace, and dignity as a single mother of two, and I am reminded that some way, some how, I can too.

To my sister...I know it has not been easy. Yet, when I needed you, you were there with love and support. You are a wonderful sister, and auntie. Miles and I are so blessed to have you in our lives.

To my dad...your intelligence astounds me. You always push me to think about alternative views, and defend my position. It is through your example that I am reminded of how important family is. Thank you for being a dad, grandpa, and friend.

Lastly, thank you to the very first boy with autism I worked with. You were three at the time, and barely said a word, but the first word I remember you saying during our therapy session was my name. It was you who taught me that *it is possible*...

## **ABSTRACT**

**DISSERTATION/THESIS/RESEARCH PAPER/CREATIVE PROJECT:** Relations Between Age, Autism Severity, Behavioral Treatment and the Amount of Time in Regular Education Classrooms Among Students with Autism

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**DEGREE:** Doctor of Philosophy

**COLLEGE:** Teacher's College

**DATE:** July, 2012

**PAGES:** 115

Under federal law, students with disabilities have the right to be educated in classrooms with students without disabilities. For students with autism, social, communication, and behavioral deficits make inclusion difficult. The severity of deficits change over time, and therefore, so too do the effects of these deficits upon inclusion. Although most research indicates autism symptoms improve with age, some studies suggest symptoms worsen, thereby affecting classroom placement. Students with autism use a multitude of interventions, most of which are not evidenced-based. Behavioral interventions are among the small number of treatments that can decrease autism severity and foster inclusion. However, behavioral interventions have not been compared to other widely used treatments, and in practice, they are rarely used in isolation. The purpose of the present study was threefold. First, relations between age, and autism severity were examined. Second, the study investigated whether relations between autism severity and time spent in regular education classrooms differed according to age. Third, it investigated types of treatments students used, and whether using behavioral treatments

moderated relations between age, autism severity and amount of time in regular education classrooms. Using a national database (Interactive Autism Network), data about the severity of social, communication and behavior deficits, treatment type, and amount of time spent in regular education classrooms were extracted from school-age students ( $n = 2646$ ) with autism. The results of the study showed that as age increased, social deficits increased. Furthermore, younger students, and students with more severe social impairment spent less time in regular education classrooms. Age also predicted use of behavioral treatment, and students who used behavioral treatment spent more time in special education classrooms. The findings of this study reflect the current climate of autism knowledge, which emphasizes early, intensive intervention. Consequently, students who were younger, and used behavioral treatments, were likely to be in special education classrooms that could maximize individualization, and associated treatment benefits. This is important, as social deficits increase with age, and reduce the amount of time students spend in inclusive classrooms. Additional studies are needed to further understand how behavioral treatment, compared to or used in conjunction with other commonly used treatments, affects inclusion.

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## CHAPTER I

### INTRODUCTION

The prevalence of autism spectrum disorders (henceforth referred to as autism, unless otherwise noted) has increased over the years with current national estimates indicating that 110 per 10,000 children aged 3 to 17 years have autism (Kogan et al., 2009). The disorder was first described by Kanner in 1943, and it was only in 1990 that federal legislation recognized autism as a disability category requiring special education services (Hallahan, Kauffman, & Pullen, 2009). Under the Individuals with Disabilities Education Improvement Act 2004 (IDEA), students with disabilities are entitled to a free, appropriate public education in schools with students without disabilities. A continuum of alternative placements is typically considered to meet the educational needs of students; but, full inclusion in regular education classrooms is often the ultimate goal, as it reflects students' ability to participate and perform well in a mainstream environment.

Yet, the amount of time students with disabilities spend in a classroom with students without disabilities varies, depending upon the level of functioning. Autism severity changes over time (Seltzer et al., 2003), sometimes in response to treatment (Myers & Johnson, 2007). However, students with autism often are placed in more restrictive classroom settings (Bitterman, Daley, Misra, Carlson, & Markowitz, 2008). An understanding of autism-related behaviors and treatments that influence the amount of time students with autism spend in inclusive environments at different ages is needed.

The purpose of the present study was to examine relations among age, autism severity, treatment, and the amount of time students spend in regular education classrooms.

### **Autism Characteristics and the Impact on Learning**

Autism is marked by deficits in social and communication skills, and restricted, repetitive, or stereotyped patterns of behaviors and interests, and it is these deficits that can adversely affect learning in regular education classrooms. First, social skill deficits among students with autism interfere with learning. A cardinal feature of autism, students fail to orient toward social stimuli, and hence deficits in joint attention and imitation are typically evident. Joint attention and imitation are pivotal skills fostering incidental learning of other behaviors in schools. Unfortunately, the failure to develop either skill is related to deficits in observational learning, making it difficult for students with autism to model and learn from their peers and teachers. Furthermore, social deficits hinder students' ability to interact with teachers and peers in classrooms. Newman (2007) found that adolescents with autism were less likely to participate actively in peer groups, respond to questions, and present in front of the class, showing that social deficits adversely influence academic engagement.

Clearly, social deficits also interfere with the development of peer relationships at school. For instance, students with autism have problems adjusting their way of interacting according to different social situations; consequently, they might speak to peers as if speaking to an adult or teacher. For some, social interactions may be desired. Yet, socially awkward behavior impedes students' ability to make and maintain friendships; therefore, students with autism often are socially isolated. Furthermore, students who desire peer relationships, yet experience multiple failures in social

interactions, are likely to experience anxiety. Bellini (2006) identified a reciprocal interaction between anxiety, social skills, and peer interactions; social dysfunction adversely affected peer interactions, and in turn, this led to increased anxiety toward future peer interactions. Students who are anxious in relation to their poor social skills may lack the focus, and motivation critical for performing other academic tasks at school.

Deficits in language also adversely affect learning among students with autism. Poor language comprehension reduces the ability to follow verbal instructions; and even among those who have average language comprehension, identifying relevant points during teachers' lectures is difficult. Further, since adolescents with autism often use language in literal, concrete ways, it is likely they also struggle with understanding the abstract, figurative language dominating middle and high school curriculum. Goldstein and colleagues (1994) found that among high functioning adolescents with autism reading comprehension was poor compared to peers of typical development. Adolescents who can read still may struggle to infer meaning from literary works consisting of metaphors, idioms, or humor due to their language deficits.

Lastly, repetitive, restricted, or stereotyped behaviors and interests can interfere with learning. In fact, repetitive, restricted interests and behaviors have been related to deficits in executive functioning, a skill critical for planning, organizing, and monitoring behavior in the classroom (Turner, 1999). Ozonoff and colleagues (1994) found children and adolescents with autism demonstrated perseveration on measures of inhibition and cognitive flexibility; therefore, participants had difficulty stopping an ongoing, automatic behavior to switch tasks and plan a different, more suitable response. A student with autism in a classroom may show cognitive rigidity by persisting in a strategy that fails to

produce the desired answer, instead of developing alternative ways of solving problems. Joseph (1999) suggested this pattern of cognitive rigidity was most evident on tasks that required the use of more obscure rules to plan responses. Rather, children tend to perform best when given explicit rules, which may be problematic given the implicit nature of instructions in middle and high school classrooms. With ongoing failure to solve academic problems due to restricted, repetitive interests and related cognitive rigidity, students often become frustrated, and show aggressive, or disruptive behaviors. These problem behaviors, related to academic frustrations, are compounded by associated difficulties communicating their need for help (Farmer & Aman, 2011).

Other studies have shown that restricted interests are related to attention deficits. Mayes and Calhoun (2007) found children's attention was highly selective, in which they focused upon restricted, self-selected interests or activities for long periods of time. A child with autism may intensely attend to irrelevant aspects of an object in the classroom environment, failing to identify and focus on more relevant features of class content, due to these restricted interests. Rinehart and colleagues (2001) also found that children and adolescents with autism demonstrated poor performance on attention shifting tasks, indicating participants had deficits disengaging attention. Poor attention shifting was affected by the speed and expectancy of the task; therefore, students with autism had problems making rapid changes in their expectations. An intense, restricted interest, or activity can make it difficult for students to shift their attention from their preferred activity to required academic tasks at school (Mayes & Calhoun, 2007; Tsatsanis, 2004). Of course, if the subject of the lesson overlaps with their interests, students may excel. If not, students could struggle to focus upon tasks that do not match their restricted

interests, since they may lack the motivation to engage in different academic tasks. Unfortunately, problem behaviors can occur when students are forced to participate in activities that do not coincide with their restricted interests.

A considerable degree of variability in symptom severity exists, which makes for a diverse profile in school performance. The deficits among students with autism often result in uneven academic achievement, with students performing much higher or lower than intelligence tests would predict (Jones et al., 2009; Mayes & Calhoun, 2003a). Furthermore, research studies suggest that the severity of deficits in social, communication, and repetitive, restricted, interests and behaviors can vary over time (Eaves & Ho, 1996; Seltzer, Shattuck, Abbeduto, & Greenberg, 2004), and thereby differentially affect students' performance in school. Ultimately, it is this variability in autism symptoms, within and between subjects, and over time, which can make it difficult to determine appropriate classroom environments for students with autism.

### **Amount of Time in Regular Education Classrooms**

The passing of PL 94-142 in 1975 (Education for All Handicapped Children Act) stated students with disabilities are to be educated with peers of typical development to the maximum extent possible, and since then, including students with disabilities in regular education classrooms has been an ever-increasing trend. However, including students who have been identified with autism in particular has a fairly short history, given its recent recognition as a disability under federal law. To date, research shows most students with autism spend at least part of their school day in a regular education classroom (Bitterman et al., 2008; Newman, 2007; Yianni-Coudurier et al., 2008), in part because parents favor inclusion (Kasari, Freeman, Bauminger, & Alkin, 1999; Stolber,

Gettinger, & Goetz, 1998; Whitaker, 2002), and perceive opportunities for integration to be important for fostering positive cognitive and emotional outcomes (Hume, Bellini, & Pratt, 2005). Yet, students with autism spend more time in special education classrooms, compared to students with other disabilities (Bitterman et al., 2008), indicating factors related to classroom placement may differ from students with other disabilities.

Age influences the amount of time spent in regular education classrooms among students with autism. Eaves and Ho (1997) found that younger students were more likely to be placed in regular education classrooms compared to older students. The authors posited that younger, lower functioning students are more easily accommodated in regular education classrooms in elementary schools since the academic and cognitive demands are less. An elementary school-aged student often uses rote memory, and concrete, rule-based thinking to learn, and these are strengths among some students with autism (G. Goldstein et al., 1994); as a result, young students with autism might excel in regular education classrooms. Yet, middle and high school curricula might not meet the needs of older, lower functioning students with autism. Abstract, logical reasoning, critical thinking, and problem solving skills are often deficits among students with autism (G. Goldstein et al., 1994), making it difficult for adolescents to perform these academic skills in regular classrooms.

The amount of time spent in regular education settings also varies according to the severity of impairment. Upon examining preschool children with autism, Yianni-Coudurier and colleagues (2008) showed that the severity of maladaptive behaviors, particularly stereotypical and self-injurious behavior, was associated with the amount of time spent in regular education classrooms. Not surprisingly, students with more problem

behaviors spent less time in regular education classrooms. Other studies have shown that the severity of autism-specific behaviors influenced the amount of time in regular classrooms. As evidenced by scores on the Childhood Autism Rating Scale, students who had more autism symptoms, and especially more social skill deficits, spent more time in special education classrooms compared to their peers (Eaves & Ho, 1997; Yianni-Coudurier et al., 2008). However, autism severity changes over time (Seltzer et al., 2003); and therefore it is not clear how the relationship between autism severity and the amount of time spent in regular education classrooms differs according to age.

### **Treatment**

The possibility of poor academic performance and restrictive classroom placement underscores the importance of identifying treatments that foster greater integration into regular classrooms. A wide array of options is available for the treatment of autism. Just a simple search of the Internet, using the terms “autism” and “treatment” yield a number of websites claiming to treat, and even cure autism. The heterogeneity of autism makes it difficult to identify any one treatment that works for all children on the spectrum. However, the National Research Council for Educating Children with Autism (2001) recommended using comprehensive treatment programs, of sufficient intensity (i.e., at least 20 hours per week), to target multiple developmental domains. Dawson and Osterling (Schwartz, Sandall, McBride, & Boulware, 2004), and Levy and colleagues (S. Levy, Kim, & Olive, 2006) also noted that effective programs for students with autism share certain features. First, effective programs include a multi-component, comprehensive curriculum addressing attention, imitation, social, language, play skills, and problem behavior in a learning environment that is predictable, and routine. Second,

skills should be taught using supportive teaching, and strategies for generalization. Third, parent involvement is a critical feature of effective programs, for parents who are actively involved in their child's intervention learn and apply teaching techniques throughout the day. As a result, parents can help enhance, and maintain their child's newly learned skills. Lastly, effective programs utilize a functional approach to problem behaviors and teach children alternative ways of conveying their needs. Applied behavioral analysis and related behavioral intervention often meet each of these criteria for effective programs for students with autism.

The definition of applied behavior analysis is “the science in which procedures derived from the principles of behavior are systematically applied to improve socially significant behavior to a meaningful degree and to demonstrate that the procedures employed were responsible for the improvement in behavior” (Cooper, Heron, & Heward, 2007). The language conveys that evidenced-based behavioral strategies are used for changing practical and socially meaningful behavior. To that end, applied behavioral analysis has a solid history of developing techniques to foster the acquisition of skills that can help students learn and participate in regular education classrooms. For instance, Lovaas' (1987) landmark study showed that at an average age of seven years nearly 50% of participants, compared to only 2% of participants in the control group, achieved normal intellectual functioning and regular education classroom placement following intensive behavioral intervention. A follow up study (McEachin, Smith, & Lovaas, 1993) conducted on a small sample of children from the original Lovaas study showed that at a mean age of 12 years, eight of nine children maintained their normal intellectual and academic functioning, indicating that the results of early behavioral

intervention have the potential to persist into early adolescence. A number of recent meta-analyses also have shown medium to large effects of long-term intensive behavioral treatment on intellectual, social, language, and adaptive functioning (Eldevik et al., 2009; Peters-Scheffer, Didden, Korzilius, & Sturmey, 2011; Virues-Ortega, 2010), and published reports demonstrate behavior analytic techniques are useful for decreasing disruptive behavior (Frazier et al., 2010; L. K. Koegel, Singh, & Koegel, 2010). Therefore, behavioral intervention has broad applicability for the treatment of main deficits and ancillary problems in children with autism; subsequently, students are able to spend more time in regular education classrooms (Reichow & Wolery, 2009).

Yet, behavioral intervention is just one type of autism treatment. Autism affects multiple areas of functioning, and thus, a wide variety of treatments often are used. For instance, Green and colleagues (2006) identified over 100 treatments that had been used by children on the spectrum. Parents reported using more than one treatment for their child's autism, averaging six to seven different treatments at any given point in time (Green et al., 2006; Kohler, 1999; Smith & Antolovich, 2000). The most widely used treatment parents reported was speech therapy (Green et al., 2006; Kohler, 1999; Newman, 2007), and a multitude of alternative diets (e.g., casein-free) and therapies (e.g., craniosacral manipulations) were frequently reported (Green et al., 2006; S. E. Levy, Mandell, Merhar, Ittenbach, & Pinto-Martin, 2003; Smith & Antolovich, 2000). Parents also reported using programs based on principles of applied behavior analysis, albeit to a lesser extent (Green et al., 2006). Although parents reported using a variety of treatments, it is not known which student characteristics (i.e., social, communication, behavior

deficits) influenced the number and types of treatments used, and if these treatments ultimately influenced integration into mainstream environments.

## **Conclusion**

In sum, deficits of autism can present challenges to learning in the classroom. As a result, students with autism often are placed in restrictive classroom settings, although this may vary according to age, autism severity, and treatment. A number of gaps exist in the literature, however.

First, most of the prior studies on the amount of time spent in regular education classrooms among students with autism were performed nearly 15 years ago, just at the cusp of advances in early identification and intervention, and only a few years after autism was included under federal law. Adolescents in particular may not have had the advantage of early identification and intervention. The amount of time spent in regular education classrooms among students with autism might differ from those in the past.

Second, prior studies show autism severity affects the amount of time spent in regular education classrooms. Yet, autism severity changes over time, and thus, it is unclear how the influence of autism severity on the amount of time spent in regular education classrooms differs for students at varying ages. This is a significant gap, since autism severity and classroom placement can change, particularly after treatment.

Applied behavior analysis is one of the few treatments that can decrease autism severity, and influence classroom placement. Although applied behavior analysis is used often, it is not known which autism characteristics are associated with its use, compared to other types of treatments. Furthermore, most studies of behavioral intervention have not been compared to other widely used treatments (Reichow & Wolery, 2009), and since

multiple treatments are often used simultaneously, it is not clear how behavioral treatment, compared to, or used in conjunction with other commonly used interventions, relates to the amount of time spent in regular education classrooms.

### **Purpose of Study and Research Questions**

The purpose of the present study was to replicate and expand upon prior studies of the relations among age, autism severity, treatment and amount of time spent in regular education classrooms. Questions of interest included:

1. Is autism severity related to age?
2. If so, does the relationship between autism severity and amount of time spent in regular education classrooms differ according to age?
3. What are the different types of treatments students with autism use?
  - a. Are age and autism severity related to the number of treatment types?
  - b. Are age and autism severity related to the use of behavioral types of treatment, in particular?
  - c. Does the relationship between age, autism severity, and amount of time spent in regular education classrooms differ for students who use behavioral types of treatment compared to students who do not use behavioral types of treatment?

### **Significance of Study**

Upon obtaining a diagnosis of autism, a fairly intensive search for treatment begins, and while providers try to offer information, most parents report not being satisfied with the information they receive (Mansell & Morris, 2004). Studies have shown that professionals have inadequate knowledge of autism critical for counseling parents on

treatment options (Mavropoulou & Padeliaadu, 2000; Shah, 2001), and despite legislation's push for using evidence-based practices (e.g., No Child Left Behind Act of 2001), providers rarely use them in practice (Hess, Morrier, Heflin, & Ivey, 2008). Accordingly, parents often rely upon different sources, including other providers, friends, books, and the Internet, to identify treatments (Mansell & Morris, 2004). At times, the information gathered is conflicting, and unsupported, resulting in parents not knowing which treatments are helpful for supporting students with autism in mainstream environments. The fact that autism is such a heterogeneous disorder only adds to the difficulty of identifying appropriate treatments. Hence, parents and providers alike find it difficult to determine interventions for students with autism that relate to more inclusive environments.

This study attempted to add to the literature by providing information on not only how age and autism severity influenced the amount of time spent in regular education classrooms, but also how treatment influenced this relationship. Unlike rigidly controlled experimental studies of efficacy, this study highlighted commonly used, everyday practices, and ways in which they were associated with student characteristics, and integration in classrooms. Although this study did not demonstrate the direct effects of treatment, it was intended to help parents and professionals identify types of treatments that may relate to more time spent in regular education classrooms.

## CHAPTER II

### LITERATURE REVIEW

#### **History of Autism**

The triad of symptoms referred to as autism was first described by Kanner in 1943 (Kanner, 1943). The 11 children described, 3 girls, 8 boys, each had a history marked by difficulty relating to others in a social way. Kanner observed that the people in their environment were viewed as tools, or objects used for the purpose of achieving their goals. The children did not show interests in playing or interacting with others. If urged to interact, a child ignored a person's plea like he did not exist, and if that failed, a child would respond, using a short, flat reply or tantrum, to stop him from interfering in his ongoing activity. The parents described their children as being independent, and content being alone. Notably, more than 1 parent stated their child lived "in a world of his own," oblivious to his environment, the exception being a rather intense, obsessive interest in objects.

The children often demonstrated greater interest in objects compared to persons. In fact, Kanner observed that the children had relations to objects instead of persons, and often showed anger, joy, or excitement upon interacting with objects. A persistent, overwhelming desire for sameness was evident, and any change in routine was often marked by crying, yelling, or tantrums. It looked as if their world was viewed in pieces,

rather than a coherent whole, and once experienced, it always had to be presented in the exact same order.

Lastly, striking deficits in communication were observed. The children had a history of delayed language, and parents often suspected hearing loss since children failed to respond if spoken to. Of the 11 children, 3 were mute, and though the remaining 8 had the ability to speak, they did not use it in a social way. The language spoken was inflexible, and literal, with meaning derived solely from the original context in which it was learned; it was lacking in spontaneity, creativity, and diversity. The children often demonstrated excellent cognitive ability including rote memory; however, Kanner noted their conversation was no more than an exercise in memory, for their speech often reflected a list of isolated, unrelated facts centered upon their obsessive interests. The use of words was rarely directed to any person in particular, showing no acknowledgement of others' role in conversations. For some, speech was echoic, void of context, and offered no personal insight into the child's thinking.

The cluster of symptoms described was called "autism," derived from the Greek stem "autos," meaning self. The term was originally coined by Bleuler (Volkmar & Klin, 2005), a psychiatrist studying schizophrenia; therefore, the term had the intended meaning of withdrawal into the self. However, the use of the term by Kanner may have played a role in the early confusion about the distinction of schizophrenia and autism. In fact, autism, as a distinct disorder, was not present in the initial Diagnostic and Statistical Manual (DSM) of 1952. Schizophrenic reaction, of childhood type, described autism as a psychotic reaction consistent with schizophrenia (American Psychiatric Association, 1952). The DSM-II of 1968 (American Psychiatric Association, 1968) maintained a

similar description of autism. Schizophrenia, childhood type, was described as “cases in which schizophrenic symptoms appear before puberty. The condition may be manifested by autistic, atypical and withdrawn behavior; failure to develop identity separate from the mother's; and general unevenness, gross immaturity and inadequacy of development...” Therefore, autism was simply viewed as the early manifestation of childhood schizophrenia. A key, often overlooked, remark by Kanner (1943) in his original paper was that the observed inability to relate to others was evident from the beginning of life, which is a striking contrast to the regression manifested in schizophrenia. The third version of the DSM (American Psychiatric Association, 1980), however, acknowledged autism as a distinct clinical entity, and notably, it outlined the onset of autism as occurring in the first 30 months of life.

The criteria for autism did not identify a particular etiology, however. Kanner's (1949) initial description of the parents led to controversy about the role of parents in the disorder. Interestingly, the parents were highly intelligent, and very objective to the point of being emotionally absent. Parents did not display a sincere interest in others, preferring any activity that did not involve interacting with people. The parents, like their children, had obsessive interests, and in fact, reported on their child's development in precise detail, akin to their child's style of speech. Parenting was regarded as a job, performed in a rather mechanical way. Kanner (1949) observed, “A child was essentially the object of an interesting experiment and can be put aside when he is not needed for this purpose.” The parents were therefore indifferent, in an “unapologetic” way, showing little physical affection. If present, the display of emotion was shown objectively in response to children's remarkable memory and visual spatial skills. Kanner suggested that children

with autism developed unusual talents, subsequent to their obsessions and compulsions, to obtain the affection of their parents; the extraordinary skill was of little value, yet it elicited the pride of their parents. Cautiously, he wondered if the extreme social withdrawal was a way of seeking comfort in the midst of an aloof, cold environment.

The detailed observations of parents' behavior may have played a role in the understanding of autism as a disorder of psychogenic origins. Even Kanner (1949) questioned if the obsessive, cold nature of the parents was a factor in autism. A "failure to develop an identity separate from the mother's" in the DSM-II (American Psychiatric Association, 1968) description of autism was indicative of the prevailing psychoanalytic theory of the time, and the emphasis upon parent-child relationships in disorders. The psychoanalytic view of autism suggested that it was a disorder of arrested or regressive development to a normal autistic or narcissistic stage, marked by disturbance in distinguishing object-person, or self-other relationships (Walker-Kennedy, 1988). The child perceived all things and persons in the environment to be extensions of him, meant to satisfy his needs; therefore, he related to persons like inanimate objects.

Psychoanalysts of the time offered varied explanations of autism. For instance, Tustin proposed autism reflected a defense mechanism against the trauma of being separated from a mother who might have, due to her own depressed state, showed little affection (Tustin, 1994). Autism, according to Rutter, was an extreme reaction to perceived, not necessarily actual, rejection of the mother (Walker-Kennedy, 1988). Lastly, Bettelheim suggested autism was a sign of the child's accurate perception of the mother's cold, detached nature (Walker-Kennedy, 1988). The mother had to support the child's transition from the narcissistic or autistic stage of development into a stage of

understanding the distinction between self and other. A child with autism must not have had his needs adequately met by his mother. Notably, several psychoanalysts of the time, including Mahler and Meltzer, proposed autism was innate (Hobson, 1990), and even Kanner claimed that given the presence of symptoms at the beginning of life, parents' behavior unlikely accounted for the totality of autism (Kanner, 1949). However, the psychoanalytic theories prevailed at the time, and thereby led to the perpetuation of the psychogenic view of autism, and unfortunately, the development of ineffective treatments.

Over 20 years elapsed before a different etiological theory was presented. In 1964, Bernard Rimland published "Infantile autism: The Syndrome and the Implications for a Neural Theory of Autism," which argued against a psychogenic view of autism (Rimland, 1964). Instead, he presented evidence of a potential genetic link, and suggested autism was due to dysfunction in the reticular activation system, a subcortical structure that plays a role in regulating arousal and attention. To date, studies have supported a genetic link to autism (Hallmayer et al., 2011), again a finding first described by Kanner, albeit misinterpreted. Furthermore, evidence of potential dysfunction in the reticular activation system (Buchwald et al., 1992), and other neural structures, such as the amygdala (Groen, Teluij, Buitelaar, & Tendolkar, 2010; Schumann, Barnes, Lord, & Courchesne, 2009), hippocampus (Groen et al., 2010), and frontal cortex (Holmboe et al., 2010), have been found. The parents' behavior was a milder form of the behavior displayed by their children, and not likely the cause of the disorder. The shift in the understanding of autism also led to a shift in the development of treatments. For instance, research on the efficacy of behavioral treatments for children with autism began to be

published (Ferster & Demyer, 1962; Lovaas, Koegel, Simmons, & Long, 1973; Lovaas, Schreibman, & Koegel, 1974).

In sum, the definition of autism has undergone revisions through the years. However, it is rather amazing that the key features first described by Kanner in 1943 have stood the test of time. To date, autism, according to the Diagnostic Statistic Manual IV Text Revised (American Psychiatric Association, 2000), is defined as qualitative impairments in social, and communication skills, and repetitive, restricted, stereotyped interests, behaviors, or activities, evidenced before the age of 3 years. Although the exact etiology is not known, the present view is that it is a neurological disorder of multifactorial origins. Further, two points about autism must be kept in mind. First, it is a developmental disorder, and while symptoms may abate or change over time, it is a lifelong disorder. Second, there is great heterogeneity in autism. A high rate of co-existing disorders (e.g., mental retardation, attention deficits) (Hofvander et al., 2009; Kim, Szatmari, Bryson, Streiner, & Wilson, 2000) makes for a complex presentation. Autism symptoms, in isolation and combination, contribute to a vast spectrum. The label of autism may help to focus treatment efforts, however, any treatment must be individualized, and designed to target a number of symptoms over a wide range of severity levels. The next sections will outline the current state of knowledge about autism features and treatments.

### **Autism: From Birth to Adolescence**

Autism is evident during the first 3 years of life. Unlike typically developing infants, infants with autism do not show a preference for speech sounds (Klin, 1991), nor do they demonstrate a social smile (Maestro et al., 2005), showing that even in infancy,

children with autism show a lack of interest in basic social stimuli. Osterling and Dawson (1994) also found that looking at faces, and making eye contact were not evident in children at 1 year of age or less. If they do look at faces, children with autism often pay less visual attention to the human face, especially the eyes and mouth, compared to children of typical development (Chawarska & Shic, 2009). Taken together, these findings indicate that children along the spectrum do not display early indicators of social interest in others; instead, infants with autism are more likely to orient to objects, or other non-social aspects of their environment (Maestro et al., 2005).

Joint attention deficits often are among the first recognized symptoms of autism. Joint attention is the ability to coordinate attention with others, often through eye contact, showing, giving, reaching or pointing. It is a pivotal skill infants develop, which lays the foundation for sharing interests, engaging others, and learning language. Yet, most infants with autism fail to develop joint attention. Werner and colleagues (2000) found, upon viewing home videos, that children later diagnosed with autism did not point to or show objects in the first year of life. Rather, infants and toddlers pulled caregivers' arms to get their attention, and request objects. Notably, this failure to engage in joint attention was specific to children with autism, compared to other developmentally delayed children, making it a distinguishing feature of autism (Osterling & Dawson, 1994). Joint attention parallels the development of intentional behavior, as the gestures of reaching, giving, and pointing reflect multiple communication functions, including requesting objects or interaction, calling attention to self or objects, and rejecting objects or actions (Owens, 2011). Yet, children with autism often fail to develop an early speech or gestural system of communication if they do not demonstrate joint attention skills. For some, joint

attention does develop, although it is rarely used for social sharing; instead, joint attention is used mostly for gaining access to a desired object, showing that people in their environment are used for instrumental rather than social purposes. Mundy and colleagues (1994) found that among high functioning children, responding to joint attention was not a deficit; but, disturbances in initiating joint attention, a marker of social sharing, often persisted, suggesting a lack of motivation for interacting in the social world. The failure to initiate or respond to joint attention bids reflects a subsequent failure to establish the basic foundation of reciprocal interactions. In fact, a number of reports have shown that joint attention deficits have been related to later social (Mundy & Crowson, 1997) and language deficits (Mundy et al., 2007; Mundy & Newell, 2007; Murray et al., 2008), and the severity of autism symptoms (Mundy et al., 1994; Naber et al., 2007). A disturbance in joint attention suggests children are not receiving information typically obtained through these skills; consequently, this adversely affects later social, language, and play development (Mundy & Crowson, 1997).

A number of these skills are acquired via imitation, at least in typically developing infants and toddlers. Ingersoll (2008) outlined 2 developmental functions of imitation. First, a child's ability to attend to, abstract from, and imitate a model fosters the relatively quick acquisition of social, language, and play skills. Second, imitation has a social function, whereby children adopt an understanding of reciprocal interactions. However, children with autism show gross deficits in imitation skills; this is not surprising given that imitation requires a child to attend to the model, and most children with autism already have difficulty attending to social aspects of their environment. Specifically, children with autism have demonstrated deficits in oral-facial imitation, and

vocal imitation (Prizant, 1996; Rogers, Hepburn, Stackhouse, & Wehner, 2003); consequently, their range of vocal behavior in infancy is fairly limited (Prizant, 1996). Imitation deficits in children with autism also have been associated with deficits in joint attention, receptive and expressive language, and play (McDuffie, Yoder, & Stone, 2005; Rogers, Hepburn, Stackhouse et al., 2003; Stone & Yoder, 2001). Taken together, disturbances in eye contact, joint attention, and imitation skills during infancy and early childhood have adverse effects on developing reciprocal interactions, and the subsequent social, language, and play skills that often emerge in these contexts. Importantly, the failure to develop these skills during infancy and early childhood hinders their ability to learn from everyday interactions in their environment.

The development of speech and language is delayed in children along the spectrum, the exception being children with Asperger's syndrome. Unlike typically developing toddlers who can say an average of 50 words between 18 and 24 months of age, most children with autism have yet to say their first meaningful word. In fact, parents often recognize speech delay as one of the first signs of their child's disability (Coonrod & Stone, 2004; McConkey, Truesdale-Kennedy, & Cassidy, 2009; Young, Brewer, & Pattison, 2003). A small proportion of children demonstrate regression in language skills around the second or third year of life. After a period of seemingly normal language development, regression is marked by a loss of the meaningful use of words, and a failure to learn new words (Davidovitch, Glick, Holtzman, Tirosh, & Safir, 2000; Lord, Shulman, & DiLavore, 2004). Among children with autism who do not have a history of language regression, Tager-Flusberg and colleagues (1990) found that not only is language delayed, but the rate of language acquisition also is slower compared to non-

autistic children with developmental delays. For instance, children that acquire speech in the first few years of life show significant lags in using multiword phrases, and often the size of their vocabulary is much smaller (Tager-Flusberg et al., 1990). A relatively small vocabulary is linked to the aforementioned deficits in joint attention; however, it also might be related to children's difficulty attending to multiple, relevant cues in their environment. Unlike typical children who use a variety of implicit and explicit cues, and salient object features to learn new words, children with autism fail to identify relevant cues to help them learn and differentiate object labels.

A small vocabulary is not evident among high functioning children with autism; yet, this does not imply that comprehension deficits do not exist. Rather, studies suggest children with high functioning autism also have poor language comprehension, particularly in natural real-life contexts. A failure to integrate implicit cues including gestures, tones, and facial expressions, adversely affects language comprehension. It has been suggested that the explicit information presented in a structured, laboratory setting conflicts with the implicit information typically presented in real-life social situations (Begeer, Meerum Terwogt, Rieffe, Stegge, & Koot, 2007); in so doing, some studies have provided misleading evidence of language comprehension skills among high functioning children. Therefore, while language knowledge among high functioning children might seemingly be extraordinary, deficits in the social use and understanding of language persist.

Using language socially depends upon understanding the role of speaker and listener. Among typically developing children, play often provides a context for practicing these social roles. For instance, songs and other games provide opportunities

for children and parents to alternate roles and vocalizations; it is this seemingly simple exchange that promotes turn-taking, reciprocity, and social scripts for future interactions. However, children with autism often prefer to play alone, and the play skills they display are atypical. Unlike typically developing children who use objects in symbolic, or pretend play, children with autism show little indication of symbolic play (McDonough, Stahmer, Schreibman, & Thompson, 1997; Sigman et al., 1999). Rather, objects are played with in a repetitive, nonfunctional way. For example, a child may play with a spoon, spinning it, while making vocalizations; in contrast, a typically developing child might pretend a spoon is a sword while interacting with a peer. Thus, delays in symbolic thought parallel deficits not only in play, but social skills as well.

A failure to understand roles during social interactions also could be evidenced by pronoun reversals among children with autism. Even among typically developing children, errors in pronoun use occur, but it often is marked by confusion of I vs. me or mine, rather than I vs. you; studies suggests that this is evidence typically developing children display understanding of the distinct role of I and you, or speaker and listener (Owens, 2011). Among children with autism, pronoun reversals take either form (i.e., I vs. me or mine, and I vs. you). At one point, this was believed to be a simple manifestation of echolalia (Kanner, 1943). But, more recent interpretations of pronoun reversals among children with autism suggest this behavior may reflect difficulty shifting roles of speaker and listener in conversations (Lee, Hobson, & Chiat, 1994).

Also, the range of functions for the use of social language is restricted among children with autism during early childhood. Although a preschool child has a tendency to engage in monologues, and self-dialogues to guide their thinking and actions, and

practice social roles, he understands the reciprocal nature of conversations, and by 4 years of age, most of his speech is socially directed (Owens, 2011). A typically developing child will ask, or respond to questions, comment, repeat, or request clarification to initiate, take-turns, or maintain a topic of conversation, even if it is rather short-lived. Among children with autism, asking questions, commenting, and describing occurs less often, whereas identifying, or naming occurs more often (Ziatas, Durkin, & Pratt, 2003). A deviant feature of language among some children with autism is immediate or delayed echolalia, or repetition of speech using the same intonation as the original utterance; and, some authors suggest that echolalia can have varying functions, including asking for objects, answering questions, requesting clarification, taking turns, maintaining interactions, or rehearsing to foster information processing (Dobbinson, Perkins, & Boucher, 2003; Prizant & Duchan, 1981; Prizant & Rydell, 1984). The use of immediate echolalia, in particular, often decreases with gains in language (McEvoy, Loveland, & Landry, 1988), as children typically use it if they do not have language to initiate or respond using spontaneous (Tager-Flusberg & Calkins, 1990). With decreases in echolalia, the range of functions for using language in social situations also decreases.

The types of discourse children with autism engage in show little diversity, and creativity. For instance, verbal children with autism often tell less complex, and creative stories (Tager-Flusberg, 1995), and they are less likely to use narratives compared to children of typical development (Capps, Kehres, & Sigman, 1998). Losh and Capps (2003) also found that high functioning children often required more prompting to elaborate upon narratives than children of typical development. The use of language is often concrete, and literal, rather than imaginative, demonstrating inflexibility in the use

and understanding of language. This fairly infrequent use of creative storytelling and narratives suggests a lack of interest in social sharing.

The deficits in social language persist for the school age child with autism. A typically developing school age child, unlike the preschool age child, can successfully introduce, and sustain a topic of conversation through several turns, make comments pertinent to the topic, and adjust the content of their conversation based upon the listener's knowledge (Owens, 2011). If there is a breakdown in communication, children will provide more background information to foster the listener's understanding, or request the speaker to clarify his comments. Yet, among children with autism the overall rate of initiating conversations, via joint attention, asking questions, or introducing topics is fairly low (Tager-Flusberg, 1996). Children with autism also have difficulty sustaining the topic of conversations, often by misjudging the amount of information needed to support the listener's understanding. For instance, a child with autism will not provide sufficient background information in conversations, but instead will assume the listener shares the same knowledge as the speaker. If asked a question, a child may reply briefly (e.g. "yes"), rather than elaborate, showing a failure to interpret cues underlying the intent of the question. Conversely, a child may respond to a question by providing too much detail. Furthermore, irrelevant, or inappropriate comments are made during conversations, demonstrating difficulty sustaining the topic. Among high functioning children, they might excel in literal interpretations, but not understand non-literal elements such as slang, and humor (Gunter, Ghaziuddin, & Ellis, 2002; Koning & Magill-Evans, 2001; Martin & McDonald, 2004); and therefore, children may struggle to make comments appropriate to the topic of conversation. These behaviors indicate school

age children with autism have problems understanding social rules, and thus determining information that may be relevant to the listener's needs.

The aforementioned problems in social uses of language are partly due to perspective taking deficits. Theory of mind refers to the capacity to infer others' mental states including emotions, beliefs, and intentions. A well-developed theory of mind enables individuals to take the perspective of others, infer their mental states, and then predict their reactions. High functioning children with autism demonstrate considerable deficits in theory of mind, unrelated to verbal intelligence, as evidenced by poor identification of relevant social cues and subsequent inference of mental states (Happé, 1995; Kaland et al., 2005). For a child of typical development, social adjustment depends upon the perception of both implicit (e.g. tone, facial expressions) and explicit cues, to then make inferences of the intent of others (Crick & Dodge, 1994). This, in turn, makes possible judgments critical for formulating an acceptable social response. Yet, perception of nonverbal cues (e.g., gestures, tone, facial expressions) in particular is impaired among children with autism. In fact, Klin (2000) posited that children with autism do not demonstrate deficits in social cognition per se, but rather social perception. For instance, children are more likely to attend to objects, rather than faces, during social situations (Klin, Jones, Schultz, Volkmar, & Cohen, 2002); thus, there is a failure in the initial acquisition of relevant, often implicit, social cues. Other studies suggest that even when faces are attended to, children with autism demonstrate abnormal decoding of facial expressions (Happé & Frith, 2006; Lindner & Rosen, 2006); children pay attention to specific facial features, rather than the gestalt, thereby hindering their interpretation of emotions. A lag in awareness of affective states of self and others is also evidenced by

children's infrequent use of mental, or affective words (Hobson & Lee, 1989; Van Lancker, Cornelius, & Needleman, 1991; Ziatas, Durkin, & Pratt, 1998), Hence, children with autism have difficulty developing an appropriate social response due to difficulty understanding emotional, and nonverbal cues. This is particularly problematic in social situations due to the need to acquire rapidly presented implicit social information (e.g. gestures, tone, facial expressions) to then continue the process of interpreting the speaker's message. Again, poor social perception often compounds delays in social, language, and play skills, because a social perceptual deficit implies that the individual does not perceive the input needed to learn these skills. These deficits in understanding unstated social cues translate into problems interacting with others, and forming relationships (Koning & Magill-Evans, 2001).

The development of peer relationships during childhood often occurs in the context of play. However, poor play skills can adversely affect peer relationships. For some, engaging in repetitive, stereotypical play is preferred over playing with peers. Although parental reports show children with autism have multiple opportunities to interact with peers, the restricted nature of their interests precludes their willingness to engage peers who do not share the same interests (Carrington, Templeton, & Papinczak, 2003). Furthermore, children's restricted interests and activities make it difficult to interact with peers if they cannot disengage from their obsessions. As a result, this failure to engage others in play has negative effects on the development of peer relationships.

Abnormal restricted interests also are manifested in children's way of conversing. A pedantic style of speech often is used among high functioning children with autism. Speech consists of lengthy, monotone, monologues of seemingly irrelevant factual

information, demonstrating poor understanding of the reciprocal nature of conversations, and poor use of prosody to convey intent. A manifestation of obsessions, children with high functioning autism might engage in detailed conversations of their particular interests, failing to realize their partner's boredom. Further, children have difficulty integrating information, and hence, they may engage in conversations of unorganized, unrelated information. A failure to convey interests in a coherent way often leads to breakdowns in peer interactions. Also, it is not uncommon for children to abruptly end conversations due to disinterest in their partner's topic of interest. Subsequently, this paucity in understanding reciprocity impedes the formation of meaningful peer relationships during the school age years.

The extent of these aforementioned social and language deficits varies over the course of development. To date, the literature has shown a trend of overall symptom improvement from early childhood through adolescence. A follow up of Kanner's original 11 children showed improvements in social, language, and play behavior (Kanner, 1949). For instance, children, around the age of 6, abruptly started to use spontaneous rather than echoic language, for the purposes of communication. Unlike the distinct isolation that marked early childhood, the children had more, albeit limited, social contact. Further, persons in their environment had a rather utilitarian purpose of satisfying needs, answering questions, and providing facts, but they also were tolerated to the extent that responding to their demands curbed their protracted interfering. More recent studies on the course of autism development have supported this trend of overall symptom improvement from early childhood to adolescence. For instance, research on early and middle childhood samples have shown substantial gains in social and

communication skills (H. Goldstein, 2002; Myers & Johnson, 2007); and among adolescents, Seltzer and colleagues (2003) found social, communication, and repetitive, or restricted interests or behaviors, often were milder than earlier stages of development.

Yet, other reports show that some symptoms persist, emerge, or deteriorate. Seltzer and colleagues (2004) showed that although most individuals with autism eventually acquired speech, adolescents still demonstrated difficulty with affective terms, prosody, and pragmatic language. Further, adolescents had ongoing difficulty showing emotional reciprocity, using and understanding nonverbal behaviors, and making friends (Seltzer et al., 2004). The persistence of social deficits also has been related to the emergence of anxiety, and depression symptoms particularly among high functioning adolescents (Ghaziuddin, Ghaziuddin, & Greden, 2002; Kim et al., 2000), given they are likely to be aware of their social differences, and they often blame themselves for their failed attempts at social interactions (Butzer & Konstantareas, 2003; Humphrey & Lewis, 2008). A few studies also have shown a worsening in symptoms. Eaves and Ho (1996) found that slightly more than half of the participants, at a mean age of 12 years, deteriorated in intelligence, autistic symptoms, aggression, or hyperactivity. Ballaban-Gil and colleagues (1996) also found a high percentage of adolescents had maladaptive behaviors. Notably, most of these studies demonstrating deterioration were performed prior to advances in identification, and increases in availability of treatment.

In sum, the development of social communication skills is critical as it fosters learning and interpersonal relationships. The use of language helps to convey thoughts, feelings, and interests, and achieve social goals. However, most individuals with autism demonstrate early social and language deficits that adversely affect later learning and

social interactions. Although symptoms generally improve, social and language deficits may persist, and problem behaviors can emerge.

### **Academic Achievement**

The persistence, emergence and deterioration of deficits over the course of development can adversely affect learning in the classroom. Again, the aforementioned deficits, most notably interfere with incidental, and observational learning. However, other information processing deficits also can disrupt learning. For example, sensory disturbances are commonly reported among children with autism. Rogers and colleagues (2003) found that children with autism showed sensitivity to sounds, touch, taste and smell more often than children of typical development. A child with autism may be under-stimulated, and thus engage in some form of self-stimulatory, or sensory-seeking behaviors; conversely, he can be over-stimulated and show stereotypical or problem behaviors to reduce the stimuli (Ashburner, Ziviani, & Rodger, 2008). Ashburner and colleagues (2008) suggested that these stereotypical behaviors might reflect a preference for repetitive, predictable sensory input. This can be problematic for children with autism due to the rapidly changing, unpredictable stimuli common to classrooms. For instance, sounds, smells, pictures, and arrangement of desks vary among classrooms, and therefore, may be overly stimulating for a child with autism; consequently, the unpredictability of sensory stimuli in a classroom can make it difficult for children to learn from teachers' instruction. In fact, sensory disturbance, as evidenced by under-responsive sensitivity, has been associated with poor academic performance among children with autism (Ashburner et al., 2008).

Additionally, auditory filtering deficits have been found. Alcatara and colleagues (2004) showed that children with autism had greater difficulty with speech recognition in the midst of background noise than peers of typical development; this finding indicates that children may have problems recognizing verbal instructions delivered by a teacher in a noisy classroom. Problems with auditory filtering also have been associated with poor attention (Ashburner et al., 2008), suggesting children with autism struggle to focus on academic tasks in noisy classroom environments. Thus, sensory disturbance, either in the form of abnormal sensitivity, or auditory filtering deficits, can result in problems attending to, and processing incoming information in the classroom.

Other deficits in information processing, beyond sensing and encoding, can interfere with learning among children with autism. A number of studies have found children with autism have exceptional rote memory (Mayes & Calhoun, 2003b; Tsatsanis, 2004), evidenced by their ability to recall discrete points or facts. However, rote memory often does not foster deeper processing of information critical for later retrieval. For instance, Boucher and Lewis (1989) found children with autism had trouble recalling prior experiences in a testing session, although recall improved when given cues. The authors contended this pattern of behavior was indicative of retrieval, rather than encoding deficits. The ability to advance in academic content, or grade levels, often requires students to link current, novel information with prior knowledge, and yet, children with autism have difficulty organizing, and integrating past and novel information into meaningful wholes, without direct, explicit cues. Furthermore, the concrete way of thinking makes it difficult to abstract, generalize, and apply information learned in class to new situations (G. Goldstein et al., 1994; Tsatsanis, 2004). Hence,

retrieval deficits, along with problems organizing and integrating information, poses challenges to learning and developing meaningful interpretations of class material for children with autism.

Children with autism also lack the basic skills essential for academic achievement. Eaves and Ho (1997) found that teachers provided poor ratings for children with autism in the areas of paying attention, following instructions, working independently, and completing tasks. An inability to perform these tasks is in part related to deficits in executive functioning. Consequently, adolescents with autism who struggle with remembering homework, organizing tasks, and managing their time will likely have difficulty completing multiple assignments in a timely manner. Academic achievement might be adversely affected given these problems with self-management.

The aforementioned deficits among children and adolescents with autism lead to discrepant academic outcomes. For instance, studies of children and adolescents with autism of average intelligence often show average reading, spelling, and numerical operations, and below average reading comprehension and written expression (G. Goldstein et al., 1994; Jones et al., 2009; Mayes & Calhoun, 2008; Minshew, Goldstein, Taylor, & Siegel, 1994); therefore, while some reports suggest academic achievement and intelligence are correlated among children of average intelligence (Eaves & Ho, 1997; Mayes & Calhoun, 2003a), others have shown a significant gap (Jones et al., 2009), indicating a potential learning deficit. Among low functioning children with autism, poor performance on math, spelling, and writing consistent with intelligence levels has been found (Mayes & Calhoun, 2003a). However, a small proportion of

children also show very high reading or arithmetic ability despite low intellectual functioning (Jones et al., 2009; Mayes & Calhoun, 2003a).

The discrepant academic achievement outcomes are explained by the unique cognitive skills of children with autism. For example, a number of reports suggest rote memory, and concrete, rule-based thinking are strengths among students with autism (G. Goldstein et al., 1994); and, these skills are critical to decoding and word recognition. As a result, children with autism are likely to demonstrate average or above average reading and spelling skills. On the other hand, abstract, logical, deductive thinking, and perspective taking are deficits among children and adolescents with autism; therefore, reading comprehension and written expression often are less than anticipated, given their intellectual functioning. Other studies have shown that poor performance on measures of writing also could be related to visual motor integration deficits (Barnhill, Hagiwara, Myles, & Simpson, 2000; Mayes & Calhoun, 2007). Barnhill and colleagues (2000) contended that children's poor visual motor integration skills might be because children are either highly distractible, or overly concerned with detail in reproducing symbols. In fact, studies have shown a relationship between graphomotor skills, attention and academic achievement in reading and written expression; deficits in attention and visual motor integration adversely affected academic achievement in these areas (Mayes & Calhoun, 2007). Importantly, if children do not develop these higher level cognitive skills (i.e., attention, abstract, logical thinking), over time adolescents with autism might begin to lag behind their peers in academic achievement (G. Goldstein et al., 1994). Taken as a whole, autism symptoms and related deficits have the potential to adversely affect

learning over the course of development; and, it is this pervasive quality, which highlights the critical role of intervention over the lifespan.

### **Behavioral Interventions**

A variety of applied behavior analysis models exist, ranging from structured, adult-directed discrete trial training to naturalistic, child-directed, environmental training. However, features common to most behavioral programs include 1) the use of principles of behavior to foster the acquisition, generalization, and maintenance of skills, and reduction of problem behaviors; 2) a comprehensive curriculum targeting the acquisition of skills across multiple domains; 3) individualized plans, according to participants' strengths and weaknesses; 4) intense (e.g., 20-40 hours per week), and long-term (e.g., two years or more) treatment; 5) intervention delivered in a one-on-one setting, with gradual integration into small and large group settings; and 6) parent training to enhance participants' newly learned skills in the natural environment (Granpeesheh, Tarbox, & Dixon, 2009; Soorya, Carpenter, & Romanczyk, 2011).

The UCLA Young Autism Project was among the first early intensive behavioral intervention programs that used a discrete trial training method to teach children fundamental social, and communication skills including attention, imitation, and language. Specifically, discrete trial training consists of dividing the target skill into sub-skills and then teaching the sub-skills required to perform the complex behavior, in a very structured, adult-directed manner. An individual trial typically consists of the adult providing the antecedent, cue, or instruction, the child's response, and lastly, the consequence for the response. For instance, a teacher might state, "Show me the cup," to elicit a behavior; the child responds (e.g. points to the cup), and contingent upon the

correct behavior, the teacher provides a reinforcer (e.g. tickles). The behavioral principles of prompting, shaping, and reinforcing are used to teach the child during trials. For instance, if a child responds incorrectly, a teacher might place the object closer to the child to prompt the correct response on the subsequent trial. Trials are repeated often until the objective is mastered. Then, the next sub-skill in the hierarchy of behaviors is taught to the child. Thus, one of the advantages of discrete trial training is that it provides numerous opportunities for a child to practice a skill; subsequently, it often results in fairly rapid rates of learning, particularly during the acquisition phase. Discrete trial training has been effective in teaching initial language comprehension, production, play, and academic skills, as well as “learning to learn” (i.e. observational learning) skills, such as sitting, attending, and imitating others (Granpeesheh, Tarbox et al., 2009; Hayward, Eikeseth, Gale, & Morgan, 2009; Lovaas, 1987; Sallows & Graupner, 2005; Soorya et al., 2011).

The discrete trial treatment approach, however, often has been criticized (Granpeesheh, Tarbox et al., 2009; Skokut, Robinson, Openden, & Jimerson, 2008). First, children can become overly reliant upon adult-initiated cues. Thus, children communicate passively in response to cues, rather than initiating spontaneous communication. The adult-driven context also has been criticized for failing to mirror natural adult-child, or child-child interactions, and in turn this makes it difficult for children to generalize behavior to the natural environment. Furthermore, the reinforcers used often are artificial, or contrived, and therefore are unrelated to the child’s response; this too can pose problems for generalizing and maintaining newly learned skills. Lastly, the highly structured nature of the discrete trial teaching environment does not provide sufficient

variability in cues, or responses, to promote generalization to other contexts and behaviors. Taken together, children taught using a discrete trial method have difficulty generalizing their newly learned skills to peer interactions in a natural, social environment (Granpeesheh, Tarbox et al., 2009; Vismara & Rogers, 2010).

A different behavioral approach, addressing many of the criticisms of discrete trial training, is natural environment training. The underlying premise of natural environment training is to teach in the context of daily interactions, routines and activities. Subsequently, the child has the chance to learn and practice the skills in the contexts he will be using them. Unlike discrete trial training, the format of natural environment training is loosely structured. The child initiates teaching episodes often by reaching, pointing, or moving in the direction of a desired object, or activity. The teacher then prompts the desired behavior (e.g. vocalizing the requested object), and reinforces the child by giving him the desired activity, or object. The desired item is a natural reinforcer, or by-product of the child's behavior; therefore, the natural contingencies of the environment obtain control over the behavior. The disadvantage of natural environment training is that the number of trials for teaching a target skill is often less than that presented in discrete trial training. The advantage of natural environment training, however, is that contextual, motivational, and other antecedent cues in the natural environment obtain stimulus control, rather than the adult-directed cues presented in a highly structured discrete trial training format. Children participating in natural environment training are more likely to initiate spontaneous speech rather than passively wait for the teacher-delivered instruction (Delprato, 2001). Further, natural environment training promotes generalization of skills for several reasons. First, children are able to

practice skills in the natural setting where they will be used. Second, the reinforcers obtained are natural, and related to the behavior itself, rather than contrived. For instance, if a child points to a toy of interest, the reinforcer is obtaining the toy. The direct relationship between the reinforcer and the behavior increases the likelihood that the child will initiate the behavior in the future (Bondy & Frost, 1994; Delprato, 2001; R. L. Koegel, Koegel, & Carter, 1999). Third, the format of natural environment training more closely resembles typical adult-child interactions; thus, children begin to understand the reciprocal nature of interactions. Fourth, natural environment training has the ancillary benefit of decreasing disruptive behaviors (L. K. Koegel et al., 2010) by incorporating children's interest and natural reinforcers into training. Lastly, Schreibman, Kaneko and Koegel (1991) found that both parents and children have more positive affective responses to natural environment training compared to discrete trial training. More recent applied behavior analysis programs incorporate natural environment training into their treatment.

A number of naturalistic environmental training methods have been used to teach language to preverbal children with autism, including milieu teaching and pivotal response training. First, milieu teaching is a method of arranging the natural environment to elicit the child's interests, and then prompting the child, using time delays, models, or other cues, to foster the child's speech. The method itself includes a number of teaching strategies that differ mostly in the types of prompts used to elicit speech.

For example, the mand model is a type of milieu teaching, and as its name implies, it is based upon the verbal behavior of mand. A mand is under the control of a motivating operation, often a state of deprivation, satiation, or aversion, and the

reinforcement obtained is directly related to the motivating operation at the time (M. L. Sundberg & Michael, 2001). Simply, a mand is a person “asking” for what he wants. For instance, a child that is thirsty (motivating operation) asks for a drink (mand), and the mother gives him a cup of juice (specific reinforcer). Conversely, a child that has just had a drink will not likely be motivated to ask for it. The key to mand training is creating a teaching environment that motivates a child to engage in this type of verbal behavior. The adult therefore places items of high interest to the child in sight, though out of reach, and waits for the child to indicate interest by reaching, pointing, or moving toward the item. This creates a situation that requires the child to interact in order to obtain help. Then, the adult provides a cue or instruction (e.g. say “ball”), prompts the child to respond (e.g. model sign or speech), and then gives the child the desired item. The number of teaching episodes can be increased by giving portions of the desired item, withholding a required item needed to complete the activity (e.g. a puzzle piece), or reducing the amount of time the child can play with the item. From a training perspective, teaching mand behavior among one of the first targets is beneficial since it gives the child control over his environment, and it is the only verbal operant that directly benefits the speaker in a concrete way (Skinner, 1992; M. L. Sundberg & Michael, 2001).

Augmentative and alternative communication (AAC) strategies, using principles of behavior, can promote the use of mands in children with autism. AAC is a group of strategies used to either supplement or replace language production among nonverbal children. For instance, picture-based AAC systems often require the child to point to, or touch a symbol to communicate. However, there are several limitations to using a picture-based point or touch system such as this to mand. First, the “listener” has to be

near the speaker to discern the picture the speaker is pointing to, making it difficult to communicate over a distance. This reliance upon the proximity of the listener also reduces the likelihood of a child initiating a communication act since he often must wait for the listener to be in range (Bondy & Frost, 2001). Second, pointing is a skill that many children on the spectrum have not developed; inexact or underdeveloped pointing might make it difficult for the listener to understand the child's intended message. Third, Bondy and Frost (2001) noted that pointing to a picture does not necessarily require the child to truly interact, a goal for programs teaching children on the spectrum; thus, though pointing may serve as a mand, and display an understanding of symbols, it does not promote reciprocal social interaction. Lastly, the obvious burden of using picture-based pointing or touching systems is that it requires extra equipment that may not be readily transportable or accessible.

However, the use of manual signs or gestures to mand does not pose these obstacles. In fact, studies have shown that using an AAC strategy such as signing is effective in increasing mands (Carbone, Sweeney-Kerwin, Attanasio, & Kasper, 2010; Valentino & Shillingsburg, 2011). Studies comparing sign vs. picture based pointing systems have yielded mixed results about the ease of acquisition of mands (Schreibman & Ingersoll, 2005; Tincani, 2004). For instance, Sundberg and Sundberg (1990) found that teaching children to sign may foster faster acquisition of verbal behavior compared to picture-based pointing systems. On the other hand, the use of signs for nonverbal children on the spectrum has been criticized since it is not widely used in the community (C. T. Sundberg & Sundberg, 1990). In contrast, the pictures in a picture-based system often are recognizable to most. This eases the burden on the child's partner and promotes

interaction with more people, since parents, teachers or peers may not be willing to learn a different method of communicating. The use of sign also requires prerequisite skills including attending and motor imitation, skills that often are deficient among children with autism; while pointing might be an inexact, or underdeveloped gesture in children, it is less complex to perform compared to some manual signs.

The picture exchange communication system (PECS) was designed to avoid obstacles related to prerequisite attention, imitation, or pointing skills. PECS is a language program which uses principles of behavior to promote self-initiated communication (Bondy & Frost, 2001). Like other forms of milieu teaching, it relies upon the child indicating interest in a toy or activity, either by looking, reaching, or moving in the direction of the item, to then teach reciprocal communication skills. The first step is to teach a child to request desired objects or activities by selecting a picture and exchanging it in return for the item; during this stage, typically 2 trainers assist, a person to physically prompt the child and a “listener” to socially interact during the exchange. Upon showing interest, the trainer prompts the child to pick up the picture and give it to the listener, who then provides, and states the word for the natural reinforcer. Using concrete, natural reinforcers is of particular importance since most children on the spectrum do not respond to social reinforcers delivered during social exchanges (Bondy & Frost, 1994). The program becomes more complex in subsequent stages, requiring children to seek listeners over a distance, discriminate among symbols, make phrases, answer questions, and comment (Bondy & Frost, 2001). Again, this method helps to develop initiation by minimizing adult-directed cues and waiting for the child to approach the listener. Studies have shown that PECS has resulted in increases in initiating,

spontaneous speech, requesting, and joint attention, and decreases in maladaptive behaviors (Bondy & Frost, 2001; Charlop-Chrsity, Carpenter, Le, LeBlanc, & Kellet, 2002; Hart & Banda, 2010; Sulzer-Azaroff, Hoffman, Horton, Bondy, & Frost, 2009). Teaching PECS, signs, or picture-based pointing systems can lead to the acquisition of words, and they do not adversely affect the development of speech (Bondy & Frost, 2001). It is not clear whether PECS or signs is more effective for teaching mands, as studies suggest this is partly based on children's prerequisite skills, particularly motor imitation (Tincani, 2004). Regardless, the method of AAC chosen to teach mands should be based on both the child's skill level and the family's preference.

A different type of natural environment training often used for children with autism is pivotal response training (PRT). PRT, using principles of behavior, aims to teach skills that foster independent functioning in inclusive environments (L. K. Koegel, Koegel, Harrower, & Carter, 1999). PRT includes the basic features of natural environmental training: the child initiates activities, ideally in inclusive contexts, and with the child's preferred items, the instructor teaches skills, using the natural reinforcer related to the selected activity as a consequence. A key feature of PRT, as its name implies, is targeting pivotal behaviors. A pivotal behavior is one that if changed will lead to improvements in other untreated, related areas of functioning. For instance, joint attention often is considered a pivotal skill, and in fact, studies have shown that children receiving joint attention training demonstrate improvements in social initiations, play, imitation, and spontaneous speech (Whalen, Schreibman, & Ingersoll, 2006). Hence, an obvious benefit to teaching pivotal skills is that it leads to advances in behaviors that

otherwise would have required additional instructional time to teach in isolation (L. K. Koegel et al., 2010).

The four pivotal areas of PRT are motivation, self-initiation, responsiveness to multiple cues, and self-management (L. K. Koegel, R. L. Koegel, J. K. Harrower et al., 1999). First, motivation is a target of treatment, since children with autism lack motivation to engage in social interactions that are critical for learning social, language, play, and academic skills. The concept of motivation might seem at odds with the emphasis upon environmental cues in behavioral psychology. Yet, motivation, as used in behavioral therapy, refers to an observable increase in responsiveness to stimuli. This is typically achieved by including materials in instructional activities that have a high reinforcer value (R. L. Koegel et al., 1999). To increase motivation, strategies include incorporating students' interests, offering choices, interspersing maintenance and training trials, and using natural reinforcers; in doing so, children are more likely to participate and persist in difficult instructional tasks, and less likely to demonstrate disruptive behavior (L. K. Koegel, Koegel, Shoshan, & McNeerney, 1999). These motivational techniques also have been effective in decreasing response latency, increasing response rate and accuracy, and decreasing disruptive behavior (L. K. Koegel et al., 2010). Even incorporating children's perseverative interests can increase children's willingness to interact during class (Baker, Koegel, & Koegel, 1998).

By incorporating motivational techniques, self-initiation, another pivotal skill, also is affected. The development of self-initiation is important since it increases the chances of learning in the absence of adult instructions (L. K. Koegel, R. L. Koegel, J. K. Harrower et al., 1999). Using the aforementioned motivational procedures, children with

autism have been taught to ask questions, or seek information, and this skill has generalized to different materials, settings, and people (Esbenshade & Rosales-Ruiz, 2001; Ingvarsson & Hollobaugh, 2010; L. K. Koegel, Camarata, Valdez-Menchaca, & Koegel, 1998; Taylor & Harris, 1995). Pierce and Schreibman (1995) also found that using PRT led to increases in conversations and play initiated by children with autism. An ability to initiate communication has been related to expressive language gains (L. K. Koegel et al., 1998), in part because children who initiate are likely to acquire natural reinforcers from others in their environment. Not surprisingly, improvements in self-initiation and language have led to less restrictive classroom placements (L. K. Koegel, R. L. Koegel, Y. Shoshan et al., 1999).

The third pivotal area targeted is responsiveness to multiple cues. Among children with autism, repetitive, restricted interests and behaviors often are manifested as an all-consuming focus upon a small number of isolated, at times irrelevant aspects of objects, or events (e.g., attending to an ink smudge on a page, instead of the picture). Consequently, children with autism have difficulty attending and responding to multiple, varied, relevant cues in their environment. Again, this can adversely affect learning. PRT uses two methods to overcome this limitation, and increase responsivity to multiple cues. First, within stimulus prompts are used in which relevant features of stimuli are initially exaggerated and then gradually faded; such prompts are intended to direct children's attention to relevant stimulus cues. Second, conditional discrimination training is used; and thus, children must respond to multiple cues at the onset of training (e.g., find your *red truck* as opposed to find the *truck*). The ability to respond to multiple cues can affect a wide range of behaviors in different contexts. For instance, responding to multiple cues

can lead to improved social functioning, given that social skills often are influenced by one's ability to perceive, and integrate many cues (e.g., words, tone, gestures, facial expressions) to infer meaning. Furthermore, generalization of skills is fostered (Pierce & Schreibman, 1997a, 1997b; Stahmer, 1995) since children are taught to attend to relevant features of the environment that are present across different contexts, rather than irrelevant features that are present in very few contexts.

Lastly, self-management is key to functioning in inclusive environments where ongoing adult monitoring and feedback is unlikely. Unlike children of typical development, children with autism lack self-regulatory behaviors essential for later independent functioning. According to Koegel and colleagues (1999), self-management skills are pivotal because they increase a child's ability to initiate and monitor his own learning in the absence of adult instruction. To teach self-management, target behaviors are first identified; then children learn to identify the correct vs. incorrect target behavior, record behavior, evaluate behavior, and reinforce or recruit reinforcement for behavior. Motivation for self-management can be fostered by involving children in the process of identifying goals, and selecting reinforcers. Using self-management, children with autism have shown less disruptive behavior (L. K. Koegel, Harrower, & Koegel, 1999), stereotypic behaviors (R. L. Koegel & Koegel, 1990; Loftin, Odom, & Lantz, 2008), and topic perseveration (R. L. Koegel & Frea, 1993), and more appropriate eye gaze, facial expressions, and topic maintenance (R. L. Koegel & Frea, 1993). Taken as a whole, the development of these pivotal areas increases children's responsiveness in natural contexts, and thus increases the likelihood of learning under various social conditions.

The deficits intrinsic to autism lead to frustrations learning, and consequently problem behaviors. It is posited that maladaptive behaviors serve to convey thoughts and feelings in the absence of a well-established communication system (Durand & Merges, 2001). A functional behavior assessment is thereby needed to determine the function of problem behaviors, and identify an alternative, acceptable means of behavior. Functions of behavior vary, but typically can be classified as either attempts to access attention, tangibles, or sensory stimuli, or escape attention, demands, or aversive sensory stimuli. The topography, or form of behavior is essential for identifying and measuring behavior. Yet, understanding the function, or purpose of the behavior is perhaps more so important as it allows one to identify the variables occasioning and maintaining the behavior, and subsequently design functionally equivalent treatments. Although punishment based strategies have been effective in reducing problem behaviors such as self-injury (Lerman, Iwata, Shore, & DeLeon, 1997), aggression (Fabiano et al., 2004; Wahler & Fox, 1980), and non-compliance (Fabiano et al., 2004; Rortvedt & Miltenberger, 1994), these techniques do not provide children a way to communicate, and in fact, may lead to the other problem behaviors. Therefore, behavioral strategies designed to enhance communication, and replace problem behaviors are preferable.

A behavioral language program that depends upon the findings of functional assessments to teach alternative, acceptable communicative behaviors is functional communication training (FCT). The purpose of FCT is to teach communicative behaviors that elicit the same reinforcer, which had previously maintained the maladaptive behavior; in doing so, the motivation to engage in the problem behavior decreases. For example, a child showing problem behaviors (e.g. tantrums) maintained by escape from

demands can be taught to request a break; as a result of appropriately requesting a break, a child is provided with the desired negative reinforcer, and therefore the need to engage in the problem behavior is reduced. A key feature of FCT is that obtaining reinforcement using the alternate behavior must be more effective, and less effortful than obtaining reinforcement via the problem behavior (Powers, Palmieri, D'Eramo, & Powers, 2011). Furthermore, the child must access the reinforcer at a rate higher than the problem behavior. Therefore, it is best if the alternate behavior already is within the child's behavioral repertoire. There is evidence showing that functionally equivalent treatments, derived from functional analysis data, are effective in reducing problem behaviors, including aggression, self-injury, and tantrums (Carr & Durand, 1985; Casey & Merial, 2006; Mancil, 2006). Unlike punishment (e.g., time-out), the long-term results of FCT are likely to be maintained and generalized across persons and settings (Durand & Carr, 1991, 1992; Durand & Merges, 2001). FCT often is judged more satisfying to consumers, compared to punishment, in part because of its wide applicability and effectiveness, but also because of the fact that children develop a functional, recognizable method of communication (Durand & Merges, 2001).

The behavioral interventions previously described also have been effective in reducing problem behaviors, despite not being targeted. Koegel and Frea (1993) noted that the ancillary changes in disruptive behaviors suggests that they are among a larger response class serving the same function. Importantly, using the aforementioned behavioral techniques (e.g., mand model, PRT) save having to program further instructional time for explicitly targeting problem behaviors. Therefore, they are both time and cost effective.

Overall, applied behavioral analysis and related behavioral interventions have effectively improved social, language, academic, and play skills. Applied behavior analysis is among a rather small group of evidenced-based practices for the treatment of autism (Simpson et al., 2005). Yet, of available treatments, it is not the most commonly used (Green et al., 2006). One reason for its infrequent use is the misconceptions of behavior therapy. For instance, critics question the use of aversive techniques, partly because of media coverage of past abuses and misuses of punishment strategies (e.g., exclusionary time-out) by individuals who were not adequately trained to use such techniques. However, current ethical guidelines state that the least restrictive procedures should be used (Bailey & Burch, 2005), and often these include reinforcement-based strategies. In schools, this also is in line with federal legislation (Individuals with Disabilities Education Improvement Act, 2004), which suggests using positive behavior supports, including reinforcement for alternative replacement behaviors. Furthermore, applied behavior analysis often is viewed as tantamount to discrete trial training, and thus, other myths tend to relate to the aforementioned criticisms of this particular program. As a result, individuals fear children will be robotic, deficient in their ability to use functional skills across settings. Yet, applied behavior analysis does not apply to one specific method or program; instead, it is an umbrella term reflecting a variety of behavioral strategies to foster acquisition, maintenance, and generalization of skills. In fact, Anderson and Romanczyk (1999) commented that just about any intervention could be used in an applied behavior analytic way, if it could be described in precise behavioral terms, replicated to show effectiveness, and ultimately be of social importance to the consumer. Thus, it is possible that a number of interventions not identified in this review

use behavior analytic principles in their programs. However, the present study will place emphasis upon evidence-based procedures that have a self-identified history of using principles of behavior.

### **Summary**

The literature has demonstrated that autism symptoms change over the course of development. Although most studies have shown symptoms improve with age, other studies suggest that symptoms can persist, and potentially worsen. As a result, students with autism often demonstrate academic achievement that is discrepant with their level of intelligence; consequently, students might be placed in more restrictive classroom environments. Behavioral intervention is one of the few treatments that improve autism symptoms, and academic performance. Students often are placed in inclusive classroom environments following treatment. Yet, in practice, behavioral treatment is not the most commonly used, and it is rarely used in isolation; rather, it is likely that students use behavioral treatment in combination with a number of different treatment types. Thus, it is not clear how the use of behavioral intervention, compared to other treatments, relates to integration in regular education classrooms. The purpose of this study was to address these gaps, and investigate differences in autism severity with age, the influence these developmental differences have on the amount of time in regular education classrooms, and whether this relationship between age, autism severity and classroom placement is moderated by the use of behavioral types of treatment.

## CHAPTER III

### METHOD

#### **Participants**

Interactive Autism Network (IAN) is an on-line national research database (<http://www.iancommunity.org>). The goals of IAN are to obtain longitudinal, parent-, or self-reported data on persons with autism spectrum disorders, and provide a research registry, matching participants to autism research projects. The eligibility criteria outlined by IAN is all children (under the age of 18) and adults in the U.S. who have been diagnosed with an autism spectrum disorder. IAN includes individuals with autism, Asperger syndrome, childhood disintegrative disorder, pervasive developmental disorder not otherwise specified (PDD-NOS), pervasive developmental disorder, and autism spectrum disorder, and excludes individuals with Rett's disorder. For the purposes of the present study, data were extracted from participants whose parents reported their child was 1) 5-18 years of age, 2) diagnosed with autism, Asperger's syndrome, or PDD-NOS between the years 2000 and 2011, and 3) currently in grades kindergarten through 12 in a public school with regular education classes.

The author acknowledges the limitation of using parent report to verify children have an autism spectrum disorder. Diagnosis of autism is best determined by clinical evaluation using standardized instruments that have shown adequate reliability and validity. However, much of the research on autism has examined fairly small samples.

The use of a national on-line parent-reported survey was intended to overcome this limitation. To crosscheck participants' diagnoses, parents completed the Lifetime version of the Social Communication Questionnaire (SCQ), a screening tool for autism spectrum disorders (see Measures for description). For the present study, only those participants who had a positive screen for an autism spectrum disorder (i.e., total score of 15 or higher) were included in the study.

The final sample included 2646 (84% male) children and adolescents, at an average age of 9.14 years. Of these, parents reported their child had autism or autistic disorder ( $n = 959$ ; 36%), Asperger's syndrome ( $n = 733$ ; 28%), or PDD-NOS ( $n = 954$ ; 36%). More than 90% of the respondents identified themselves as White ( $n = 2405$ ) or non-Hispanic ( $n = 2423$ ).

A random sample of participants was selected from this group ( $n = 397$ ; 15% of entire sample) to identify the role of treatment in the relationship among age, autism severity, and amount of time spent in regular education classrooms. The average age of participants within this subset was 8.96 years, and 136 (34%) were diagnosed with autism, 113 (29%) with Asperger's syndrome, and 148 (37%) with PDD-NOS.

## **Procedures**

A parent or legally authorized guardian provided consent for children under the age of 18 years prior to participating in IAN research. Upon consent, parents registered, and provided demographic information, including age, gender, race, ethnicity, grade level and the child's first autism spectrum disorder diagnosis (i.e., autism, Asperger's syndrome, or PDD-NOS). Parents completed a series of on-line questionnaires, assessing autism severity, treatment, and amount of time spent in regular education classrooms.

## Measures

**Autism severity.** To determine autism severity, parent responses to the SCQ were assessed. The SCQ is a 40-item parent-reported instrument used to screen for autism spectrum disorders in children 4 years of age and older (Rutter, Bailey et al., 2003). Questions, derived from the Autism Diagnostic Interview-Revised (Rutter, Le Couteur, & Lord, 2003), probe the presence or absence of reciprocal social interactions (e.g., “Has she/he ever used your hand like a tool or as if it were part of her/his own body?”), communication (e.g., “Has she/he ever got her/his pronouns mixed up?”), and repetitive, restricted interests and behaviors (e.g., “Has she/he ever had any interests that preoccupy her/him and might seem odd to other people?”), using a yes/no question format. The SCQ provides total and subscale scores for the social, communication, and behavior domains. SCQ total scores range from 0 to 39, and a cutoff score of 15 is suggestive of an autism spectrum disorder. Higher scores on the social, communication, and behavior subscales indicate greater impairment in each of these areas. The SCQ demonstrates sensitivity of 0.85 and specificity of 0.75, and it is significantly correlated with total and domain scores of the Autism Diagnostic Interview-Revised, suggesting strong concurrent validity (Charman et al., 2007; Rutter, Bailey et al., 2003). Internal consistency for the total scale, and subscales are good, with Cronbach’s alpha ranging from 0.81 to 0.93 (Berument et al., 1999; Rutter, Bailey et al., 2003).

**Treatment.** Parents identified treatments their child currently used or had used in the past from a list compiled by the IAN research team. The treatment list included a range of biological (e.g., biofeedback), skill-based (e.g., Edmark Reading Program), and therapeutic (e.g., animal therapy) supports. If not listed, parents had the opportunity to

describe the type of treatment used for their child. Using a modified version of Heflin and Simpson's classification system (Heflin & Simpson, 1998; Simpson et al., 2005), number and types of treatment were derived by organizing treatments into 1 of 11 categories: medical and pharmacological treatments (e.g., risperidone), alternative therapies, diets and supplements (e.g., gluten-free diet), physiological and sensory therapies (e.g., auditory integration treatment), skill-based behavioral (e.g., applied behavior analysis), cognitive (e.g., social stories), and other academic, communication, social, and motor skill therapies (e.g., occupational therapy), psychoanalytic and relationship-based therapies (e.g., holding therapy), school and center-based classes and programs (e.g., adaptive P.E.), non-standard therapies (e.g., music therapy), physical, leisure and extracurricular activities (e.g., martial arts), and parenting practices (e.g., 1-2-3 Magic by Dr. Thomas Phelan).

**Amount of time in regular education classrooms.** Parents identified the relative amount of time spent in regular and special education classrooms, on a scale of 1 to 5. Parents answered, "How would you best describe your child's classroom setting?" and selected either "1) regular education classroom for ALL of child's school day, 2) more time in REGULAR EDUCATION classroom than special education classroom, 3) same amount of time in regular education and special education classrooms, 4) more time in SPECIAL EDUCATION classroom than regular education classrooms, or 5) special education classroom for ALL of child's school day." Higher scores indicated students spent more time in special education classroom settings.

## CHAPTER IV

### RESULTS

#### **Descriptive Statistics**

Table 1 shows the means, and standard deviations for students' ages, and the total and subscale social (SOC), communication (COM) and behavior (BEH) scores for the group, and diagnostic subgroups. As a group, the average SCQ total score was 24.66 ( $SD = 5.41$ ; range 15 to 39), and ratings of the amount of time spent in regular education settings indicated students spent more time in regular education classrooms compared to special education classrooms ( $M = 2.51$ ;  $SD = 1.40$ ; range 1-5).

To determine if autism severity subscale scores differed among participants with autism, Asperger's syndrome, and PDD-NOS, multivariate analysis of variance was conducted. Using Pillai's Trace, significant differences were found ( $p < .05$ ), and post-hoc tests indicated differences on each of the subscale scores. Students with autism had significantly higher social ( $M_{SOC} = 9.42$ ;  $SD_{SOC} = 3.27$ ), communication ( $M_{COM} = 8.01$ ;  $SD_{COM} = 2.20$ ) and behavior ( $M_{BEH} = 6.40$ ;  $SD_{BEH} = 1.56$ ) scores compared to students with Asperger's syndrome ( $M_{SOC} = 8.65$ ;  $SD_{SOC} = 2.97$ ;  $M_{COM} = 7.22$ ;  $SD_{COM} = 2.21$ ;  $M_{BEH} = 6.11$ ;  $SD_{BEH} = 1.59$ ) and PDD-NOS ( $M_{SOC} = 8.66$ ;  $SD_{SOC} = 3.14$ ;  $M_{COM} = 7.70$ ;  $SD_{COM} = 2.25$ ;  $M_{BEH} = 6.12$ ;  $SD_{BEH} = 1.66$ ). Students with Asperger's syndrome also had significantly lower communication scores compared to students with PDD-NOS.

**Table 1.** Means (Standard Deviations) of Age, Social Communication Questionnaire Scores, and Amount of Time Spent in Regular Education Classrooms

	Group ( <i>n</i> = 2646)	Autism ( <i>n</i> = 959)	Asperger's ( <i>n</i> = 733)	PDD-NOS ( <i>n</i> = 954)
Age	9.14 (2.76)	8.45 (2.35)	10.43 (3.02)	8.86 (2.59)
SOC*	8.93 (3.16)	9.42 (3.27)	8.65 (2.97)	8.66 (3.14)
COM*	7.68 (2.24)	8.01 (2.20)	7.22 (2.21)	7.70 (2.25)
BEH*	6.22 (1.61)	6.40 (1.56)	6.11 (1.59)	6.12 (1.66)
SCQ Total	24.66 (5.41)	25.70 (5.44)	23.83 (5.33)	24.25 (5.29)
Time in Regular Classrooms	2.51 (1.40)	2.95 (1.46)	1.83 (1.05)	2.58 (1.40)

\* $p < .05$ ; SOC = Social Subscale; COM = Communication Subscale; BEH = Behavior Subscale; SCQ = Social Communication Questionnaire

**Question 1** *Is autism severity related to age?*

To assess if autism severity was related to age, correlational analyses were conducted, using age and SCQ subscale scores as variables. Analyses were conducted on the group, and diagnostic subgroups due to significant group differences in SCQ subscale scores. Table 2 shows the correlations among age and autism severity subscale scores. For the whole group, correlational analyses showed a positive relationship between age and social subscale scores ( $r = .09, p < .05$ ), and a negative relationship between age and behavior subscale scores ( $r = -.14, p < .05$ ). As age increased, social deficits increased, and behavior deficits decreased. The Asperger's syndrome ( $r_{age \times SOC} = .10, p < .05$ ;  $r_{age \times BEH} = -.22, p < .05$ ) and PDD-NOS ( $r_{age \times SOC} = .10, p < .05$ ;  $r_{age \times BEH} = -.12, p < .05$ ) subgroups showed similar positive and negative correlations between age and social, and age and behavior subscale scores. For the autism subgroup, a positive correlation between age and social subscale scores ( $r = .17, p < 0.05$ ) also was found, but age was not

correlated with behavior subscale scores. Age, however, was positively correlated to communication subscale scores ( $r = 0.16, p < 0.05$ ) among students with autism; as age increased, so did communication deficits.

**Table 2.** *Correlations Among Age and Social Communication Questionnaire Subscales*

	Group ( $n = 2646$ )				Autism ( $n = 959$ )			
	Age	SOC	COM	BEH	Age	SOC	COM	BEH
Age	1				1			
SOC	.09*	1			.17*	1		
COM	.00	.48*	1		.16*	.47*	1	
BEH	-.14*	.07*	.14*	1	-.04	.04	.13*	1
	Asperger Syndrome ( $n = 733$ )				PDD-NOS ( $n = 954$ )			
Age	1				1			
SOC	.10*	1			.10*	1		
COM	-.05	.51*	1		.03	.45*	1	
BEH	-.22*	.15*	.15*	1	-.12*	.02	.11*	1

\* $p < .05$ ; SOC = Social Subscale; COM = Communication Subscale; BEH = Behavior Subscale

**Question 2** *Does the relationship between autism severity and amount of time spent in regular education classrooms differ according to age?*

Using the enter method, multiple linear regression analysis was conducted to determine if the relationship between autism severity, and amount of time spent in regular education classrooms differed according to age. The outcome variable was the relative amount of time spent in regular education classrooms, and the predictors were student age, social, communication, and behavior subscale scores. Age was used as the

interaction variable to assess whether it moderated the relationship between severity and amount of time spent in regular education classrooms. If predictor variables are strongly related, as in the case of including interactions between independent variables in regression, multicollinearity occurs. Multicollinearity can result in unstable estimates of the regression coefficients, and inflated standard errors (Tabachnick & Fidell, 2007); consequently, one is lead to falsely retain the null hypothesis (i.e., type II error). To decrease multicollinearity, age, social, communication, and behavior subscale scores were centered by subtracting the mean from each of the observed values. The multiple regression equation used to examine relations between age, autism severity, and amount of time in regular education classrooms was as follows:

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_1X_2 + \beta_6X_1X_3 + \beta_7X_1X_4 + \varepsilon$$

where,

Y = relative amount of time spent in regular education classrooms

X<sub>1</sub> = age

X<sub>2</sub> = social subscale scores

X<sub>3</sub> = communication subscale scores

X<sub>4</sub> = behavior subscale scores

ε = random error

If an interaction was significant, first, conditional moderators were computed by calculating the mean age, and adding and subtracting one standard deviation from the mean in order to obtain high and low values of the moderator. Second, new interaction terms were computed by multiplying the conditional moderators by the predictors. For

each significant interaction, two additional regression analyses were conducted, one using the high value, and the other using the low value of the moderator.

Regression analyses were performed on the whole group, and diagnostic subgroups due to significant group differences in SCQ subscale scores. Table 3 lists  $R$ , adjusted  $R^2$ , and regression coefficients. For the whole group, the regression model was significant ( $F(7, 2638) = 31.22, p < .05$ ). Age ( $\beta = -.13, p < .05$ ) predicted amount of time spent in regular education classrooms. Younger students were likely to spend more time in special education classrooms compared to older students. The social subscale score ( $\beta = .24, p < .05$ ) also was a significant predictor of the amount of time spent in regular education classrooms; students with more severe social deficits were likely to spend more time in special education classrooms compared to students with milder social skill deficits. Age did not moderate the relationship between either of the subscale scores and amount of time spent in regular education classrooms ( $p > .05$ ).

Among children with autism, the regression model also was significant ( $F(7, 951) = 13.90, p < .05$ ), and the main effects of age, and social deficits were predictors of the amount of time spent in regular education classrooms. Younger children ( $\beta = -.07, p < .05$ ) spent more time in special education classroom settings compared to older children, and students with more severe social impairments ( $\beta = .34, p < 0.05$ ) spent more time in special education classrooms compared to students with less severe social deficits. Communication and behavior subscale scores also predicted classroom placement. Surprisingly, students who had more severe communication ( $\beta = -.09, p < .05$ ) and

behavioral deficits ( $\beta = -.07, p < .05$ ) spent more time in regular education classrooms compared to students with less severe communication and behavioral deficits.

Unique differences in the relationship between age, autism severity, and amount of time spent in regular education classrooms were found for the Asperger's syndrome subgroup ( $F(7, 725) = 3.81, p < .05$ ). Age did not predict the amount of time spent in regular education classrooms ( $p > .05$ ). However, social and behavioral deficits did predict the amount of time spent in regular education classrooms. Students with Asperger's syndrome who had more severe social ( $\beta = .13, p < .05$ ) and behavioral ( $\beta = .10, p < .05$ ) deficits spent more time in special education classrooms compared to those with milder social and behavioral deficits.

For students with PDD-NOS, the regression model was significant ( $F(7, 946) = 7.50, p < .05$ ). Age ( $\beta = -.07, p < .05$ ) predicted amount of time spent in regular education classrooms; younger students spent more time in special education classrooms compared to older students. Further, social deficits ( $\beta = .18, p < .05$ ) were related to the amount of time spent in regular education classrooms; students who had more severe social deficits spent more time in special education classrooms compared to their peers with milder social impairments. Unlike students with autism and Asperger's syndrome, age moderated the influence of social ( $\beta = -.08, p < .05$ ) and communication ( $\beta = .07, p < .05$ ) deficits upon classroom placement. Younger students with more social deficits spent more time in special education classrooms compared to older students with similar degrees of social deficits, and older students with greater communication deficits spent more time in special education classrooms compared to younger students with similar impairments.

**Table 3.** Multiple Regression Analyses of Relations Between Age, Social Communication Questionnaire Subscales, and Amount of Time Spent in Regular Education Classrooms

	Group ( <i>n</i> = 2646)				Autism ( <i>n</i> = 959)			
	<i>R</i>	<i>AR</i> <sup>2</sup>	B (S.E.)	$\beta$	<i>R</i>	<i>AR</i> <sup>2</sup>	B (S.E.)	$\beta$
Variables	.28	.08			.31	.09		
Age			-.07 (.01)*	-.13*			-.04 (.02)*	-.07*
SOC			.10 (.01)*	.24*			.15 (.02)*	.34*
COM			.01 (.01)	.02			-.06 (.03)*	-.09*
BEH			-.02 (.02)	-.02			-.07 (.03)*	-.07*
Age $\times$ SOC			-.01 (.00)	-.03			.01 (.01)	.05
Age $\times$ COM			.01 (.01)	.03			.00 (.01)	-.01
Age $\times$ BEH			.01 (.01)	.03			.01 (.01)	.03
	Asperger's Syndrome ( <i>n</i> = 733)				PDD-NOS ( <i>n</i> = 954)			
	<i>R</i>	<i>AR</i> <sup>2</sup>	B (S.E.)	$\beta$	<i>R</i>	<i>AR</i> <sup>2</sup>	B (S.E.)	$\beta$
Variables	.19	.03			.23	.05		
Age			.00 (.01)	.00			-.04 (.02)*	-.07*
SOC			.05 (.02)*	.13*			.08 (.02)*	.18*
COM			.00 (.02)	.01			.03 (.02)	.05
BEH			.06 (.03)*	.10*			-.01 (.03)	-.01
Age $\times$ SOC			.00 (.01)	.03			-.02 (.01)*	-.08*
Age $\times$ COM			-.01 (.01)	-.07			.02 (.01)*	.07*
Age $\times$ BEH			.00 (.01)	.00			.00 (.01)	-.01

\*  $p < .05$ ; SOC = Social Subscale; COM = Communication Subscale; BEH = Behavior Subscale

**Question 3.** *What are the different types of treatments students with autism use?*

Tables 4 through 6 list the types of treatments the subset of respondents identified, and the number of students using each type of treatment. Participants identified more than 200 treatments. Of those listed, the most frequently used type of treatment was other-skill based therapy (67%), given many parents reported students used speech therapy under this category. The use of medical and pharmacological treatments also was common (54%), and nearly half (46%) of students used dietary, complementary, and alternative therapies. Almost one-third of students ( $n = 130$ ) used skill-based behavioral therapy. The mean number of treatment types students used was 3 ( $S.D. = 1.69$ ), and the range was 0 to 8. Figure 1 displays the distribution of the number of treatment types.

**Table 4.** *Biologically Based Treatments*

Medical & Pharmacological Treatments ( $n = 213$ ; 54%)	Dietary, Complementary, & Alternative Therapies ( $n = 183$ ; 46%)	Neurological, Physiological & Sensory Treatments ( $n = 94$ ; 24%)
Abilify	5-HTP	Auditory Integration Training
Actos	Acetyl L-Cysteine	Biofeedback (Neurofeedback)
Adderall	Acupuncture	Brushing/Joint Compression (Wilbarger Brushing Protocol)
Albuterol	All-purpose Multi-mineral Supplement	Deep Pressure Therapy
Alprazolam	All-Purpose Multivitamin Supplement	Doman-Delacato Patterning
Amantadine	Alpha-lipoic Acid	Interactive Metronome
Amitiza (lubiprostone)	Amino Acids (unspecified)	Sensory Integration Therapy
Amitriptyline	Antioxidants (unspecified)	Vision Therapy
Amoxapine	Aromatherapy	Weighted Blanket or Vest

Amoxicillin	Artificial Color-Free Diet
Anafranil	Artificial Flavoring-free or Restricted Diet
Anti-fungal (unspecified)	Artificial Sweetener-free Diet
Ativan	Calcium
Benadryl	Caprylic Acid
Buspar	Casein-free/Casein-limited Diet
Celexa (citalopram)	Chelation
Claritin (loratadine)	Chiropractic Care (general)
Clonazepam	Chromium
Clonidine (Catapres)	Clay Baths
Creon	Colostrum
Cymbalta	Combination Multi-vitamin/Multi-mineral Supplement
Depakote (valproic acid)	Craniosacral Therapy
Desmopressin (DDAVP)	Dairy-free (Milk-free) Diet
Dexedrine	DAN! Protocol
Diflucan (fluconazole)	Digestive Aids (e.g., GI Revive)
Effexor	Dimethylglycine
Felbatol	Egg-free Diet
Fluticasone (Flovent)	Enzymes
Fluvoxamine	Epsom Salt Baths
Focalin	Essential Fatty Acids

Gabapentin (neurontin)	Evening Primrose Oil
Geodon	Feingold Diet
Guanfacine (Intuniv, Tenex)	Fiber supplement
Hormone Therapy	Fish Oil
Hydrocortizone	GABA (Gamma-aminobutyric acid)
Hydroxyzine (Vistaril)	Gluten-free and Casein-free Diet
Invega	Glutathione/Reduced L-glutathione
Keppra	Gluten-free diet
Lamictal	Homeopathy
Laxatives & Stool Softeners	Hyperbaric Oxygen Therapy
Lexapro	Infant Massage
Lithium	Iron
Mellaril	L-Carnitine
Methylphenidate	L-Carnosine
Naltrexone	L-Glutamine
Namenda	L-Theanine
Nasonex	Magnesium
Nortriptyline	Melatonin
Nystatin	MonaVie
Paxil	Movement (Dance) Therapy
Prevacid	Nitrate-free/Nitrite-free Diet

Prilosec	Organic Diet
Propranolol	Peanut-free Diet
Provigil	Probiotics (e.g., acidophilus)
Prozac (fluoxetine)	Selenium
Pulmicort	Soy-free diet
Remeron (mirtazapine)	Special diet (unspecified)
Respen-A	Spiritual Practices (e.g., prayer)
Risperdal (risperidone)	Sugar-free/Sugar-restricted Diet
Secretin	Sulfite-free Diet
Seroquel (quetiapine)	TMG (trimethylglycine)
Singulair	Transfer Factor
Strattera	Vegetarian Diet
Tegretol (carbamazepine)	Vitamin A
Thorazine (chlorpromazine)	Vitamin B Supplement (unspecified)
Tofranil (imipramine)	Vitamin B12
Topamax	Vitamin B3
Trazodone	Vitamin B6
Trileptal (oxcarbazepine)	Vitamin B9
Valtrex	Vitamin C
Vyvanse	Vitamin E
Wellbutrin (bupropion)	Whole Grain Diet

Zoloft (sertraline)

Xango

Zyprexa

Yeast-free Diet

Zyrtec

Yoga

Zinc

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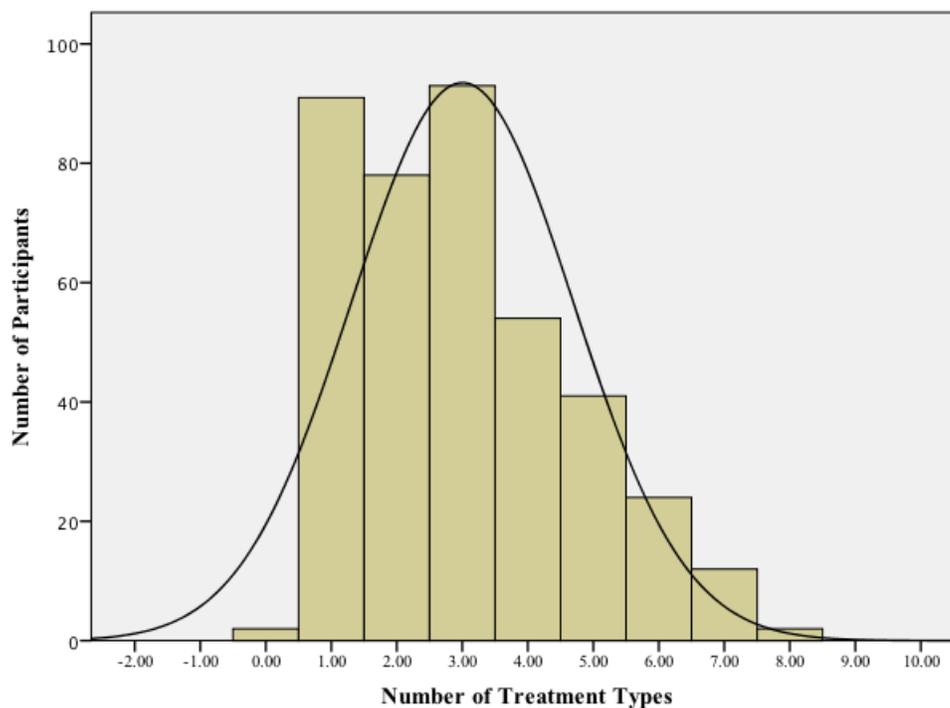
**Table 5. Skill-Based Treatments**

Skill-Based: Behavioral Therapy ( <i>n</i> = 130; 33%)	Skill-Based: Cognitive Therapy ( <i>n</i> = 141; 36%)	Skill-Based: Other Academic, Communication, Social, and Motor Skills Therapy ( <i>n</i> = 265; 67%)
Applied Behavior Analysis	Incredible 5-Point Scale	Assistive Technology
Behavioral Therapy (unspecified)	Peer Modeling	Augmentative and Alternative Communication
Discrete Trial Training	Social Skills Group	Brain Balance Center
Lovaas Method	Social Stories	Developmental Therapy
Picture Exchange Communication System (PECS)	Social Thinking	Edmark Reading Program
Pivotal Response Training	SOS (Social Skills in Our Schools; Michelle Dunn Approach)	Facilitated Communication
Verbal Behavior Therapy	Theory of Mind Training	Fast ForWord
		Feeding Therapy
		Joint Action Routines
		Lindamood-Bell Learning Processes
		Occupational Therapy
		Physical Therapy
		Rapid Prompting Method
		Speech and Language Therapy
		Treatment and Education of Autistic and Related Communication Handicapped Children (TEACCH)
		Visual Schedules

**Table 6.** *Psychoeducational, Leisure-Based, and Allied Health Treatments*

Psychoanalytic & Interpersonal Relationship Therapy ( <i>n</i> = 72; 18%)	School & Center Based Classes and Programs ( <i>n</i> = 18; 5%)	Non-Standard Therapies ( <i>n</i> = 57; 14%)	Physical, Leisure, & Extracurricular Activities ( <i>n</i> = 11; 3%)	Parenting Practices ( <i>n</i> = 7; 2%)
Developmental, Individual Differences, Relationship-Based Approach	Adaptive P.E.	Animal Therapy	Baseball	1-2-3 (Dr. Thomas Phelan)
Holding Therapy	Asperger's School Program	Aqua Therapy	Boxing	Other (e.g., tough love)
Milieu (Life Space) Therapy	Group Home	Art Therapy	Gymnastics/Little Gym	
P.L.A.Y. Project	Language Preschool	Music Therapy	Ice Hockey	
Play Therapy	Special Education		Martial Arts	
Psychotherapy/ Counseling (Talk Therapy)	Special Education Preschool		Piano	
Relationship Development Intervention				
Son-Rise Program				

**Distribution of Number of Treatment Types Used by a Subset of Students with Autism**



**Figure 1.** Distribution of number of treatment types used by a subset of students with autism

**Question 3a** Are age and autism severity related to the number of treatment types?

To determine if age, and autism severity predicted the number of different treatment types, multiple linear regression analysis was performed, as described above. The outcome variable, in this case, was number of treatment types, and the predictors were student's age, social, communication, and behavior subscale scores. Analysis was performed on the subset of respondents as a group, rather than diagnostic subgroups, due to the smaller sample size; multivariate analysis of variance also confirmed SCQ subscale scores did not differ between diagnostic groups within the subset of respondents ( $p > .05$ ). Table 7 lists  $R$ , adjusted  $R^2$ , and regression coefficients. The regression model was significant ( $F(7, 396) = 3.62, p < .05$ ), and showed that age ( $\beta = -.17, p < .05$ ), and communication subscale scores ( $\beta = -.19, p < .05$ ) predicted the number of different types

of treatments students used. Younger students used more treatment types compared to older students, and students with more severe communication impairment used fewer types of treatments.

**Table 7.** *Multiple Regression Analysis of the Relationship Between Age, Social Communication Questionnaire Subscales, and Number of Treatment Types*

	Group (n = 397)			
Variables	R	AR <sup>2</sup>	B (S.E.)	$\beta$
Age	.25	.04	-.10 (.08)*	-.17*
SOC			.03 (.03)	.06
COM			-.15 (.04)*	-.19*
BEH			.01 (.05)	.01
Age × SOC			.01 (.01)	.03
Age × COM			-.02 (.02)	-.07
Age × BEH			.02 (.02)	.05

\*  $p < .05$ ; SOC = Social Subscale; COM = Communication Subscale; BEH = Behavior Subscale

**Question 3b** *Are age and autism severity related to the use of behavioral types of treatment?*

Using the enter method, binary logistic regression analysis was conducted to determine if age, and autism severity predicted whether a child used behavioral types of treatment. The outcome variable was whether students had used behavioral therapy (yes/no), and the predictors were students' age, social, communication, and behavior subscale scores. The logistic regression equation used to assess the relationship among age, autism severity, and use of behavioral types of treatment was:

$$\ln(Y/1-Y) = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_1X_2 + \beta_6X_1X_3 + \beta_7X_1X_4 + \varepsilon$$

where,

Y = behavioral treatment

$X_1$  = age

$X_2$  = social subscale scores

$X_3$  = communication subscale scores

$X_4$  = behavior subscale scores

$\varepsilon$  = random error

Table 8 shows the regression coefficients. A test of the logistic model against a constant only model was significant ( $\chi^2(7, 397) = 49.36, p < .05$ ). Age ( $B = -.30, p < .05$ ) predicted the use of behavioral types of treatment. Younger students were more likely to use behavioral treatment compared to older students. The severity of social, communication and behavior deficits, however, did not predict the use of behavioral treatment ( $p > .05$ ).

**Table 8.** *Logistic Regression Analysis of the Relationship Between Age, Social Communication Questionnaire Subscales, and the Use of Behavioral Treatment*

Variables	Group ( $n = 397$ )		
	B	Wald	Exp(B)
Age	-.31*	32.55	.73
SOC	.02	.16	1.02
COM	-.10	2.42	.91
BEH	.06	.53	1.06
Age $\times$ SOC	-.03	1.91	.97
Age $\times$ COM	-.02	.71	.98
Age $\times$ BEH	.04	1.59	1.04

\*  $p < .05$ ; SOC = Social Subscale; COM = Communication Subscale; BEH = Behavior Subscale

**Question 3c** *Does the relationship between age, autism severity, and amount of time spent in regular education classrooms differ for students who use behavioral types of treatment compared to students who do not use behavioral types of treatment?*

To assess if behavioral treatment type moderated the relationship among age, autism severity, and amount of time spent in regular education classrooms, multiple regression analysis was performed. A dichotomous variable for treatment type was created (behavioral vs. non-behavioral treatment), and used as the interaction term in place of age. Hence, the multiple regression equation to evaluate the relations between age, autism severity, behavioral therapy and amount of time spent in regular education classrooms was:

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_5X_1 + \beta_7X_5X_2 + \beta_8X_5X_3 + \beta_9X_5X_4 + \varepsilon$$

where,

Y = the relative amount of time spent in regular education classrooms

X<sub>1</sub> = age

X<sub>2</sub> = social subscale scores

X<sub>3</sub> = communication subscale scores

X<sub>4</sub> = behavior subscale scores

X<sub>5</sub> = behavioral treatment

ε = random error

Table 9 lists *R*, adjusted *R*<sup>2</sup>, and regression coefficients for the analysis. The regression model was significant ( $F(9, 387) = 3.87, p < .05$ ), and the main effect of behavioral treatment type ( $\beta = .23, p < .05$ ) predicted amount of time in regular education classrooms. Students who used behavioral treatment spent more time in special education

classrooms compared to students who did not use behavioral treatment. The use of behavioral treatment did not moderate the relationship between age, autism severity, and the amount of time spent in regular education classrooms.

**Table 9.** *Multiple Regression Analysis of Relations Between Age, Social Communication Questionnaire Subscales, Behavioral Treatment and Amount of Time in Regular Education Classrooms*

	Group ( <i>n</i> = 397)			
	<i>R</i>	<i>AR</i> <sup>2</sup>	B (S.E.)	<i>β</i>
Variables	.29	.08		
Age			-.02 (.03)	-.03
SOC			-.03 (.03)	-.06
COM			.01 (.04)	.02
BEH			.01 (.05)	.01
BehTH			.58 (.16)*	.20*
BehTH × Age			-.11 (.07)	-.10
BehTH × SOC			-.07 (.05)	-.09
BehTH × COM			.01 (.08)	.01
BehTH × BEH			-.01 (.09)	-.01

\* *p* < .05; SOC = Social Subscale; COM = Communication Subscale; BEH = Behavior Subscale; BehTH = Behavioral Treatment

## CHAPTER V

### DISCUSSION

#### **Summary and Conclusions**

A push for greater integration of students with disabilities in regular education classrooms has been evident over the past 40 years. Often, placement in regular classrooms is a measure of optimal outcome, as it is an indicator of students' abilities to function and participate in classes with peers of typical development. In the past, this was referred to as normalization, or students with disabilities having an educational experience as close as possible to students without disabilities. It was relatively recently that IDEA recognized autism as a disability category requiring special services, and while this study does not answer whether inclusion is effective, it does shed light on how public schools have responded to including students with autism of varying ages and severity levels in regular education classrooms. The present study found that students spent at least part of the school day in regular education classrooms, and that age, autism severity, and treatment influenced the relative amount of time spent in these classrooms.

Age and autism severity were related. In particular, social deficits were associated with age for the whole group. Older students had more severe social impairment compared to younger students. Seltzer and colleagues (2003) also found that older individuals had greater social deficits compared to younger individuals, and deficits particularly in the area of peer friendships persisted over time. Peers become increasingly

important during adolescence, as the amount of time spent interacting with them increases, and peers are no longer viewed as playmates, but rather as friends whom one can trust. As a result, friendships require greater listening, perspective-taking, and emotional reciprocity. Because peers are such an integral part of development during adolescence, subsequent failures to make, and sustain friendships may become more salient during this period compared to younger children with autism spectrum disorders.

A similar relationship between age and communication scores was found for students with autism. As age increased, communication deficits also increased. This finding is in contrast with other studies documenting improvements in communication with age (Seltzer et al., 2003). At least two explanations might underlie this finding of greater communication deficits with age in the present study. Early in development, parents or siblings may unconsciously step in to make up for a student's language deficits; consequently, delays might be exacerbated among older students. Alternatively, the services available to younger children with autism are likely more intense and directly targeted toward decreasing autism-related symptoms, given the advances in autism diagnosis, and treatment over the past decade. It is possible that older individuals with autism did not benefit from such services, and therefore demonstrated greater communication deficits compared to younger students who may have been identified and treated recently.

Age also was related to behavior, with older students showing less severe behavior problems compared to younger students. Again, Seltzer and colleagues (2003) also found that their older cohort demonstrated less severe autistic behaviors (e.g., circumscribed interests, repetitive use of objects) compared to younger participants with

autism. The decrease in autistic behaviors with age could reflect symptom improvement, though without longitudinal data, this is difficult to infer. Similarly, less autistic behaviors in older students do not indicate autism is simply a childhood disorder. Rather, in this study, participants continued to show autistic behaviors, albeit to a lesser extent. Unexpected transitions, and changes in environments during early years of development might lead to more problem behaviors. Over time, it is possible that students, and supporting adults (e.g., parents, teachers) have more experience adjusting to novel situations, and establishing environments that are routine, or predictable; subsequently, problem behaviors might occur less often in older children and adolescents. Taken together, autism severity might improve, or in some cases worsen, and therefore it is possible that students will have ongoing problems learning in regular education classrooms.

Age influenced the amount of time spent in regular education classrooms.

Younger students were likely to spend more time in special education settings compared to older students, and this was particularly evident for students with autism and PDD-NOS. This finding is in contrast to Eaves and Ho's (1997) earlier study, which showed older students were more likely to be placed in special education settings. Granted, their study was conducted more than 15 years ago, and in a different country; therefore, potential differences in educational policy may account for the varying results. The present study's finding reflects the current climate of autism knowledge and intervention, which places emphasis upon early intensive treatment. Although the structure of early intervention varies, it is often conducted in smaller, less inclusive settings in order to maximize individualization. Once students develop functional skills, students typically

are integrated into more inclusive environments. A negative correlation between age and behavioral deficits also supports this finding, as older students who have fewer problem behaviors are likely able to spend more time in regular education classrooms.

A fairly consistent finding for the group and subgroups was the influence of social deficits on classroom placement. For each group, students with more severe social deficits spent more time in special education classrooms compared to students with milder social deficits. Eaves and Ho (1997) and Yianni-Coudurier (2008) also found social deficits related to time spent in regular and special education classrooms. Underlying inclusion is the philosophical belief that students with disabilities can interact with and learn from students of typical development. Among students with autism spectrum disorders, difficulty observing, modeling and interacting with others interferes with the ability to learn from peers in an inclusive classroom. Consequently, it is not surprising that more severe social deficits were related to less time in regular education classrooms.

A rather unusual finding in this study was the relationship between communication and behavior subscale scores and the amount of time spent in regular education classrooms among students with autism. Students who had greater communication and behavior deficits were likely to spend more time in regular education classrooms compared to their counterparts, and this did not differ by age. The inclusion of students with disabilities in regular education classrooms still is a hotly debated topic, with some in favor of full inclusion, regardless of the severity of disability; therefore it is possible that parents or educators advocated for students with autism to be included in regular classroom settings as much as possible. Unknown is the level of support provided

within these regular education classrooms; perhaps with adequate, intensive supports, students with autism who have severe communication and behavior deficits may be able progress in a regular education classroom.

For students with Asperger's syndrome, autistic behaviors also influenced the amount of time in regular education classrooms. Unlike students with autism, more time was spent in special education classrooms for students who had more stereotyped and maladaptive behaviors. Yianni-Coudurier (2008) also found the severity of maladaptive behaviors related to less time in inclusion classrooms. Just like others with autism spectrum disorders, students with Asperger's syndrome demonstrate repetitive, restricted interests and behaviors that can interfere with learning if they are unable to disengage from their interests. If asked to participate in class activities that do not match their interests, students can become frustrated and show disruptive, or even aggressive behaviors (e.g., tantrums). Unfortunately, these problem behaviors can compromise the learning and safety of other students in regular classrooms. Hence, students with autistic, and problem behaviors spend more time in special education classrooms where additional supports are available to manage such behaviors.

To that end, autism support took a wide variety of forms in this study. The subset of respondents reported using over 200 different treatments, from an average of 3 different categories. Because parents reported treatments were used from a number of different categories, it is important for parents and professionals to communicate with each other about the use of, or changes in treatment.

This is of particular importance since a substantial number of parents reported using treatments from categories that did not have empirical support (e.g., dietary,

complementary, and alternative therapies). This finding is consistent with Green and colleagues (2006) who noted that the absence of empirical support did not influence parental report of commonly used treatments. The use of treatments lacking empirical support has different effects depending upon the treatment. A number of interventions parents use for their child's autism might serve to complement, or enhance other forms of treatment. For instance, problem behaviors related to sensory dysfunction interfere with children's achievement, and sensory integration could help students modulate, organize, and integrate sensory input (Baranek, 2002), and thus foster students' responses to other skill-based treatments. Thus, treatments may be benign and offer potential benefit, even though they lack empirical support. However, treatments also may pose a significant danger to children (e.g., chelating). There is a potential for treatment interference, seeing that parents are likely to use more than one treatment at a time for their child. Using harmful treatments may adversely affect the outcome of more promising treatments. Unfortunately, the use of treatments lacking empirical support may result in parents losing time, money, and for the child, treatment gains.

Age related to the number of different types of treatments students used. Younger students used treatments from a number of different categories more often than their counterparts. After an initial diagnosis of autism, parents often turn to different information sources to identify treatments for their child, and since there is little information about the efficacy of available treatments, parents are likely to use several different types of treatment to help their child. Over time, parents, through trial and error, have probably excluded many of the treatments that are not useful for treating their child; therefore, older students are less likely to use several different types of treatments.

A third of parents reported using evidence-based behavioral therapy. Further, autism severity did not relate to the use of behavioral treatments. Green and colleagues (2006), in contrast, found that those with more severe autism used applied behavioral analysis treatments more often than those with milder forms of autism spectrum disorders. However, Green's study measured severity according to parents' perceptions (e.g., child did not speak indicated severe autism), rather than using standardized instruments to assess severity across the three domains of impairment. For the most part, studies demonstrating the use of principles of behavior are small group, or single-subject experimental designs. Yet, these studies have been conducted with participants across a wide range of abilities; and thus, the findings of the present study are consistent with this research, showing that in practice, behavioral therapy is used for students with varying degrees of impairment.

Age did relate to the use of behavioral treatments. Younger students were more likely to use behavioral treatments compared to older students. This finding is not surprising, as the rise in prevalence has been associated with an urgency to identify and treat students early. In fact, studies have shown that age influences the extent of benefit from therapy (Harris & Handleman, 2000). Granpeesah and colleagues (2009) found that children younger than 7 years of age demonstrated greater responses to intensive behavioral intervention compared to older children, indicating the benefits of treatment diminish as the age of a child increases. Ultimately, early intensive therapy is critical for decreasing the severity of long-term impairment; therefore, younger students are more likely to make use of behavioral treatment compared to older students.

Also, students who used behavioral treatments spent more time in special education classrooms compared to those who did not use behavioral treatment. Upon first glance, this would seem to suggest that behavioral therapy leads to more restrictive classroom settings. Clearly, prior research studies have shown that after participating in behavioral intervention, students often transition to regular education classrooms (Reichow & Wolery, 2009)). This study was not experimental or longitudinal, and respondents reported past or *current* use of treatments; therefore, one cannot conclude from the findings that behavioral treatment results in more time in special education classrooms. Rather, applied behavioral therapy is often conducted in a one-on-one or small teacher-to-student ratio setting, mirroring the structure of special education classrooms. Moreover, students who participate in behavioral intervention often are required to do so for at least 20 hours per week, which decreases the amount of time available to attend regular education classrooms. Taken together, it is possible that younger students, and students who use behavioral therapy spend more time in special education classrooms, which thereby increases individualization, and the associated benefits of such treatments.

### **Limitations and Future Research**

This study had a number of limitations. First, the sample may not have been representative of students with autism spectrum disorders, as evidenced by the disproportionate number of respondents who were White, or non-Hispanic. Also, studies based on on-line surveys are often limited to respondents that have computer access, and research suggests those without access are more likely to be non-White, of low income, and with less education (Dillman, Smyth, & Christian, 2009). Autism prevalence

estimates among children of different races and socioeconomic backgrounds vary (Kogan et al., 2009; Wiggins, Baio, & Rice, 2006; Yeargin-Allsopp et al., 2003), and thus it is not clear if autism affects students similarly. If so, a more representative sample of students with autism spectrum disorders is needed to further establish the relationship between age, autism severity, treatment and amount of time spent in regular education classrooms.

A representative sample also is of importance, as access to different treatments might vary among students of different backgrounds. Although this study investigated student characteristics, parent and school factors that might influence the use of treatments were not examined. For instance, cost, along with the availability and training of personnel may limit the use of evidence-based treatments, such as applied behavior analysis. Just the same, other factors might play a role in the amount of time spent in regular education classrooms, such as parental advocacy, and district policies on classroom placements. To ascertain obstacles to using evidence-based treatments and including students with autism in regular education classrooms, future studies should investigate other factors that may influence treatment and classroom placement decisions.

Another limitation of this study was that the definition of treatments was not provided; therefore, respondents identified treatments according to their interpretations. Consequently, it was not clear if the treatments parents listed were used for therapeutic, or different purposes. The open-ended format of the treatment portion of the survey is advantageous as it increases the amount of flexibility respondents have in providing answers (Dillman et al., 2009). Hence, respondents often identified treatments not listed on the survey, and in most cases, these were specific names substituted for general labels (e.g., Super Nu-Thera for multi-vitamin/mineral supplement) or alternative names for

treatments (e.g., Risperdal and risperidone). Yet, in other cases, it was not clear if parents' perceived treatments as distinct, or if it was a specific component of a broader treatment program (e.g., AAC used in speech and language therapy). Although categories of treatments were described, analysis of individual treatments was not conducted since parents reported treatments with varying levels of specificity.

Further, parents, teachers and therapists often will use a variety of strategies in practice, combining elements from different theoretical approaches. For instance, speech pathologists may use principles of behavior to teach students with autism to use an augmentative and alternative communication device. As a result, it is possible that parents listed treatments that may not be consistent with standard definitions used in research or practice. Future studies using a mixed methods approach may shed more light on the type of treatments used among students with autism.

Lastly, this study used a cross-sectional design. As a result, only relations, rather than effects of treatment on the amount of time in regular education classrooms were identified. It is rather difficult, however, to ascertain the relative effectiveness of different treatments for several reasons. First, as previously mentioned, multiple treatments often are used simultaneously, making it difficult to disentangle the effects of treatment. Second, the rigid design, control, and thoroughness typical of interventions in university-based, laboratory settings often do not translate to community settings (Brookman-Frazer, Taylor, & Garland, 2010), which, as noted above, makes measuring the integrity of treatment difficult. This study sought to describe a more "real-world" depiction of treatments commonly used in everyday practice. Prior research has demonstrated the effects of behavioral treatments in particular on children with autism; but most studies

have not compared it to other widely used treatments (Reichow & Wolery, 2009). If possible, large group longitudinal and experimental studies, among students across a wide range of ages, are needed to compare the effects of varying treatment approaches on the amount of time spent in regular education classrooms.

To conclude, students with autism spend time in inclusive classroom environments, although the amount of time they spend in regular classrooms tends to vary with age, autism severity, and treatment type. Students with autism, though they share features, vary vastly, and thus, no single classroom placement or intervention may benefit each person on the spectrum. Therefore, it is critical for goals to be individualized to meet each student's specific needs. Although a regular education classroom might be an optimal outcome, it is important to provide students with additional evidence-based supports, and if needed alternative classroom placements, due to the potential of persistent, or worsening in autism symptoms.

## REFERENCES

- Alcantara, J. I., Weisblatt, E. J., Moore, B. C., & Bolton, P. F. (2004). Speech-in-noise perception in high-functioning individuals with autism or Asperger's syndrome. *Journal of Child Psychology and Psychiatry, 45*(6), 1107-1114.
- American Psychiatric Association (1952). *Diagnostic and statistical manual of mental disorders*. Washington, DC: American Psychiatric Association.
- American Psychiatric Association (1968). *Diagnostic and statistical manual of mental disorders* (2<sup>nd</sup> ed.). Washington, DC: American Psychiatric Association.
- American Psychiatric Association (1980). *Diagnostic and statistical manual of mental disorders* (3<sup>rd</sup> ed.). Washington, DC: American Psychiatric Association.
- American Psychiatric Association (2000). *Diagnostic and statistical manual of mental disorders* (4<sup>th</sup> ed., text rev). Washington, DC: American Psychiatric Association.
- Anderson, S. R., & Romanczyk, R. G. (1999). Early intervention for young children with autism: Continuum-based behavioral models. *Journal of the Association for Persons with Severe Handicaps, 24*(3), 162-173.
- Ashburner, J., Ziviani, J., & Rodger, S. (2008). Sensory processing and classroom emotional, behavioral, and educational outcomes in children with autism spectrum disorder. *American Journal of Occupational Therapy, 62*(5), 564-573.
- Bailey, J., & Burch, M. (2005). *Ethics for Behavior Analysts*. New York: Taylor & Frances Group, LLC.
- Baker, M. J., Koegel, R. L., & Koegel, L. K. (1998). Increasing the social behavior of young children with autism using their obsessive behaviors. *Journal of the Association for Persons with Severe Handicaps, 23*(4), 300-308.

- Ballaban-Gil, K., Rapin, I., Tuchman, R., & Shinnar, S. (1996). Longitudinal examination of the behavioral, language, and social changes in a population of adolescents and young adults with autistic disorder. *Pediatric Neurology, 15*(3), 217-223.
- Baranek, G. T. (2002). Efficacy of sensory and motor interventions for children with autism. *Journal of Autism and Developmental Disorders, 32*(5), 397-422.
- Barnhill, G. P., Hagiwara, R., Myles, B. S., & Simpson, R. L. (2000). Asperger syndrome: A study of the cognitive profiles of 37 children and adolescents. *Focus on Autism and Other Developmental Disabilities, 15*, 146-153.
- Begeer, S., Meerum Terwogt, M., Rieffe, C., Stegge, H., & Koot, H. M. (2007). Do children with autism acknowledge the influence of mood on behaviour? *Autism, 11*(6), 503-521.
- Bellini, S. (2006). The development of social anxiety in adolescents with autism spectrum disorders. *Focus on Autism and Other Developmental Disabilities, 21*(3), 138-145.
- Berument, S. K., Rutter, M., Lord, C., Pickles, A., & Bailey, A. (1999). Autism screening questionnaire: diagnostic validity. *British Journal of Psychiatry, 175*, 444-451.
- Bitterman, A., Daley, T. C., Misra, S., Carlson, E., & Markowitz, J. (2008). A national sample of preschoolers with autism spectrum disorders: special education services and parent satisfaction. *Journal of Autism and Developmental Disorders, 38*(8), 1509-1517.
- Bondy, A., & Frost, L. (1994). The picture exchange communication system. *Focus on Autistic Behavior, 9*(3), 1-19.

- Bondy, A., & Frost, L. (2001). The Picture Exchange Communication System. *Behavior Modification, 25*(5), 725-744.
- Boucher, J., & Lewis, V. (1989). Memory impairments and communication in relatively able autistic children. *Journal of Child Psychology and Psychiatry, 30*(1), 99-122.
- Brookman-Frazee, L. I., Taylor, R., & Garland, A. F. (2010). Characterizing community-based mental health services for children with autism spectrum disorders and disruptive behavior problems. *Journal of Autism and Developmental Disorders, 40*(10), 1188-1201.
- Buchwald, J. S., Erwin, R., Van Lancker, D., Guthrie, D., Schwafel, J., & Tanguay, P. (1992). Midlatency auditory evoked responses: P1 abnormalities in adult autistic subjects. *Electroencephalography and Clinical Neurophysiology, 84*(2), 164-171.
- Butzer, B., & Konstantareas, M. M. (2003). Depression, temperament, and their relationship to other characteristics in children with Asperger's disorder. *Journal on Developmental Disabilities, 10*(1), 67-72.
- Capps, L., Kehres, J., & Sigman, M. (1998). Conversational abilities among children with autism and children with developmental delays. *Autism, 2*(4), 325-344.
- Carbone, V. J., Sweeney-Kerwin, E. J., Attanasio, V., & Kasper, T. (2010). Increasing the vocal responses of children with autism and developmental disabilities using manual sign mand training and prompt delay. *Journal of Applied Behavior Analysis, 43*(4), 705-709.
- Carr, E. G., & Durand, V. M. (1985). Reducing behavior problems through functional communication training. *Journal of Applied Behavior Analysis, 18*(2), 111-126.

- Carrington, S., Templeton, E., & Papinczak, T. (2003). Adolescents with Asperger syndrome and perceptions of friendship. *Focus on Autism and Other Developmental Disabilities, 18*(4), 211-218.
- Casey, S. D., & Mercial, C. L. (2006). The use of functional communication training without additional treatment procedures in an inclusive school setting. *Behavioral Disorders, 32*(1), 46-54.
- Charlop-Chrsity, M. H., Carpenter, M., Le, L., LeBlanc, L. A., & Kellet, K. (2002). Using picture exchange communication system (PECS) with children with autism: Assessment of PECS acquisition, speech, social-communicative behavior, and problem behavior. *Journal of Applied Behavior Analysis, 35*(3), 213-231.
- Charman, T., Baird, G., Simonoff, E., Loucas, T., Chandler, S., Meldrum, D., et al. (2007). Efficacy of three screening instruments in the identification of autistic-spectrum disorders. *British Journal of Psychiatry, 191*, 554-559.
- Chawarska, K., & Shic, F. (2009). Looking But Not Seeing: Atypical Visual Scanning and Recognition of Faces in 2 and 4-Year-Old Children with Autism Spectrum Disorder. *Journal of Autism and Developmental Disorders.*
- Coonrod, E. E., & Stone, W. L. (2004). Early concerns of parents of children with autistic and nonautistic disorders. *Infants & Young Children, 17*(3), 258-268.
- Cooper, J. O., Heron, T. E., & Heward, W. L. (2007). *Applied Behavior Analysis, 2nd Edition*. Upper Saddle River, NJ: Pearson Education.
- Crick, N. R., & Dodge, K. A. (1994). A review and reformulation of social information-processing mechanisms in children's social adjustment. *Psychological Bulletin, 115*(1), 74-101.

- Davidovitch, M., Glick, L., Holtzman, G., Tirosh, E., & Safir, M. P. (2000). Developmental regression in autism: maternal perception. *Journal of Autism and Developmental Disorders, 30*(2), 113-119.
- Delprato, D. J. (2001). Comparisons of discrete-trial and normalized behavioral language intervention for young children with autism. *Journal of Autism and Developmental Disorders, 31*(3), 315-325.
- Dillman, D. A., Smyth, J. D., & Christian, L. M. (2009). *Internet, mail, and mixed-mode surveys: The tailored design method* (3rd ed.). Hoboken, New Jersey: John Wiley & Sons.
- Dobbinson, S., Perkins, M., & Boucher, J. (2003). The interactional significance of formulas in autistic language. *Clinical Linguistics & Phonetics, 17*(4-5), 299-307.
- Durand, V. M., & Carr, E. G. (1991). Functional communication training to reduce challenging behavior: maintenance and application in new settings. *Journal of Applied Behavior Analysis, 24*(2), 251-264.
- Durand, V. M., & Carr, E. G. (1992). An analysis of maintenance following functional communication training. *Journal of Applied Behavior Analysis, 25*(4), 777-794.
- Durand, V. M., & Merges, E. (2001). Functional communication training: A contemporary behavior analytic intervention for problem behaviors. *Focus on Autism and Other Developmental Disabilities, 16*(2), 110-119.
- Eaves, L. C., & Ho, H. H. (1996). Brief report: stability and change in cognitive and behavioral characteristics of autism through childhood. *Journal of Autism and Developmental Disorders, 26*(5), 557-569.

- Eaves, L. C., & Ho, H. H. (1997). School placement and academic achievement in children with autistic spectrum disorders. *Journal of Developmental and Physical Disabilities, 9*(4), 277-291.
- Eldevik, S., Hastings, R. P., Hughes, J. C., Jahr, E., Eikeseth, S., & Cross, S. (2009). Meta-analysis of Early Intensive Behavioral Intervention for children with autism. *Journal of Clinical Child and Adolescent Psychology, 38*(3), 439-450.
- Esbenshade, P. H., & Rosales-Ruiz, J. (2001). Programming common stimuli to promote generalized question-asking: A case demonstration in a child with autism. *Journal of Positive Behavior Interventions, 3*(4), 199-210.
- Fablano, G. A., Pelham, W. E., Manos, M. J., Gnagy, E. M., Chronis, A. M., Onyango, A. N., et al. (2004). An evaluation of three time-out procedures for children with attention-deficit/hyperactivity disorder. *Behavior Therapy, 35*(3), 449-469.
- Farmer, C. A., & Aman, M. G. (2011). Aggressive behavior in a sample of children with autism spectrum disorders. *Research in Autism Spectrum Disorders, 5*(1), 317-323.
- Ferster, C. B., & Demyer, M. K. (1962). A method for the experimental analysis of the behavior of autistic children. *American Journal of Orthopsychiatry, 32*, 89-98.
- Frazier, T. W., Youngstrom, E. A., Haycook, T., Sinoff, A., Dimitriou, F., Knapp, J., et al. (2010). Effectiveness of medication combined with intensive behavioral intervention for reducing aggression in youth with autism spectrum disorder. *Journal of Child and Adolescent Psychopharmacology, 20*(3), 167-177.

- Ghaziuddin, M., Ghaziuddin, N., & Greden, J. (2002). Depression in persons with autism: Implications for research and clinical care. *Journal of Autism and Developmental Disorders, 32*(4), 299-306.
- Goldstein, G., Minshew, N. J., & Siegel, D. J. (1994). Age differences in academic achievement in high-functioning autistic individuals. *Journal of Clinical and Experimental Neuropsychology, 16*(5), 671-680.
- Goldstein, H. (2002). Communication intervention for children with autism: a review of treatment efficacy. *J Autism Dev Disord, 32*(5), 373-396.
- Granpeesheh, D., Dixon, D. R., Tarbox, J., Kaplan, A. M., & Wilke, A. E. (2009). The effects of age and treatment intensity on behavioral intervention outcomes for children with autism spectrum disorders. *Research in Autism Spectrum Disorders, 3*(4), 1014-1022.
- Granpeesheh, D., Tarbox, J., & Dixon, D. R. (2009). Applied behavior analytic interventions for children with autism: A description and review of treatment research. *Annals of Clinical Psychiatry, 21*(3), 162-173.
- Green, V. A., Pituch, K. A., Itchon, J., Choi, A., O'Reilly, M., & Sigafos, J. (2006). Internet survey of treatments used by parents of children with autism. *Research in Developmental Disabilities, 27*(1), 70-84.
- Groen, W., Teluij, M., Buitelaar, J., & Tendolkar, I. (2010). Amygdala and hippocampus enlargement during adolescence in autism. *Journal of the American Academy of Child & Adolescent Psychiatry, 49*(6), 552-560.

- Gunter, H. L., Ghaziuddin, M., & Ellis, H. D. (2002). Asperger syndrome: tests of right hemisphere functioning and interhemispheric communication. *Journal of Autism and Developmental Disorders, 32*(4), 263-281.
- Hallahan, D. P., Kauffman, J. M., & Pullen, P. C. (2009). *Exceptional Learners: An introduction to special education* (11th ed.). Boston: Pearson Education, Inc.
- Hallmayer, J., Cleveland, S., Torres, A., Phillips, J., Cohen, B., Torigoe, T., et al. (2011). Genetic Heritability and Shared Environmental Factors Among Twin Pairs With Autism. *Archives of General Psychiatry.*
- Happé, F. (1995). The role of age and verbal ability in the theory of mind task performance of subjects with autism. *Child Development, 66*(3), 843-855.
- Happé, F., & Frith, U. (2006). The weak coherence account: detail-focused cognitive style in autism spectrum disorders. *Journal of Autism and Developmental Disorders, 36*(1), 5-25.
- Harris, S. L., & Handleman, J. S. (2000). Age and IQ at intake as predictors of placement for young children with autism: a four- to six-year follow-up. *J Autism Dev Disord, 30*(2), 137-142.
- Hart, S. L., & Banda, D. R. (2010). Picture exchange communication system with individuals with developmental disabilities: A meta analysis of single subject studies. *Remedial and Special Education, 31*(6), 476-488.
- Hayward, D., Eikeseth, S., Gale, C., & Morgan, S. (2009). Assessing progress during treatment for young children with autism receiving intensive behavioural interventions. *Autism, 13*(6), 613-633.

- Heflin, L. J., & Simpson, R. L. (1998). Interventions for children and youth with autism: Prudent choices in a world of exaggerated claims and empty promises. Part I: Intervention and treatment option review. *Focus on Autism and Other Developmental Disabilities, 13*(4), 194-211.
- Hess, K. L., Morrier, M. J., Heflin, L. J., & Ivey, M. L. (2008). Autism treatment survey: services received by children with autism spectrum disorders in public school classrooms. *Journal of Autism and Developmental Disorders, 38*(5), 961-971.
- Hobson, R. P. (1990). On psychoanalytic approaches to autism. *American Journal of Orthopsychiatry, 60*(3), 324-336.
- Hobson, R. P., & Lee, A. (1989). Emotion-related and abstract concepts in autistic people: evidence from the British Picture Vocabulary Scale. *Journal of Autism and Developmental Disorders, 19*(4), 601-623.
- Hofvander, B., Delorme, R., Chaste, P., Nyden, A., Wentz, E., Stahlberg, O., et al. (2009). Psychiatric and psychosocial problems in adults with normal-intelligence autism spectrum disorders. *BMC Psychiatry, 9*, 35.
- Holmboe, K., Elsabbagh, M., Volein, A., Tucker, L. A., Baron-Cohen, S., Bolton, P., et al. (2010). Frontal cortex functioning in the infant broader autism phenotype. *Infant Behavior and Development, 33*(4), 482-491.
- Hume, K., Bellini, S., & Pratt, C. (2005). The usage and perceived outcomes of early intervention and early childhood programs for young children with autism spectrum disorder. *Topics in Early Childhood Special Education, 25*(4), 195-207.

- Humphrey, N., & Lewis, S. (2008). 'Make me normal': the views and experiences of pupils on the autistic spectrum in mainstream secondary schools. *Autism, 12*(1), 23-46.
- Ingersoll, B. (2008). The social role of imitation in autism: Implications for the treatment of imitation deficits. *Infants and Young Children, 21*(2), 107-119.
- Ingvarsson, E. T., & Hollobaugh, T. (2010). Acquisition of intraverbal behavior: teaching children with autism to mand for answers to questions. *Journal of Applied Behavior Analysis, 43*(1), 1-17.
- Jones, C. R., Happe, F., Golden, H., Marsden, A. J., Tregay, J., Simonoff, E., et al. (2009). Reading and arithmetic in adolescents with autism spectrum disorders: peaks and dips in attainment. *Neuropsychology, 23*(6), 718-728.
- Joseph, R. M. (1999). Neuropsychological frameworks for understanding autism. *International Review of Psychiatry, 11*(4), 309-324.
- Kaland, N., Moller-Nielsen, A., Smith, L., Mortensen, E. L., Callesen, K., & Gottlieb, D. (2005). The Strange Stories test--a replication study of children and adolescents with Asperger syndrome. *European Child and Adolescent Psychiatry, 14*(2), 73-82.
- Kanner, L. (1943). Autistic disturbances of affective contact. *Nervous Child, 2*, 217-250.
- Kanner, L. (1949). Problems of nosology and psychodynamics of early infantile autism. *American Journal of Orthopsychiatry, 19*(3), 416-426.
- Kasari, C., Freeman, S. F., Bauminger, N., & Alkin, M. (1999). Parental Perspectives on Inclusion: Effects of Autism and Down Syndrome. *Journal of Autism and Developmental Disorders, 29*(4), 297-305.

- Kim, J. A., Szatmari, P., Bryson, S. E., Streiner, D. L., & Wilson, F. J. (2000). The prevalence of anxiety and mood problems among children with autism and Asperger syndrome. *Autism, 4*, 117-132.
- Klin, A. (1991). Young autistic children's listening preferences in regard to speech: a possible characterization of the symptom of social withdrawal. *Journal of Autism and Developmental Disorders, 21*(1), 29-42.
- Klin, A. (2000). Attributing social meaning to ambiguous visual stimuli in higher-functioning autism and Asperger syndrome: The Social Attribution Task. *Journal of Child Psychology and Psychiatry, 41*(7), 831-846.
- Klin, A., Jones, W., Schultz, R., Volkmar, F., & Cohen, D. (2002). Visual fixation patterns during viewing of naturalistic social situations as predictors of social competence in individuals with autism. *Archives of General Psychiatry, 59*(9), 809-816.
- Koegel, L. K., Camarata, S. M., Valdez-Menchaca, M., & Koegel, R. L. (1998). Setting generalization of question-asking by children with autism. *American Journal of Mental Retardation, 102*(4), 346-357.
- Koegel, L. K., Harrower, J. K., & Koegel, R. L. (1999). Support for children with developmental disabilities in full inclusion classrooms through self management. *Journal of Positive Behavior Interventions, 1*(1), 26-34.
- Koegel, L. K., Koegel, R. L., Harrower, J. K., & Carter, C. M. (1999). Pivotal response intervention I: Overview of approach. *Journal of the Association for Persons with Severe Handicaps, 24*(3), 174-185.

- Koegel, L. K., Koegel, R. L., Shoshan, Y., & McNERNEY, E. (1999). Pivotal response intervention II: Preliminary long-term outcome data. *Journal of the Association for Persons with Severe Handicaps*, 24(3), 186-198.
- Koegel, L. K., Singh, A. K., & Koegel, R. L. (2010). Improving motivation for academics in children with autism. *Journal of Autism and Developmental Disorders*, 40(9), 1057-1066.
- Koegel, R. L., & Frea, W. D. (1993). Treatment of social behavior in autism through the modification of pivotal social skills. *Journal of Applied Behavior Analysis*, 26(3), 369-377.
- Koegel, R. L., & Koegel, L. K. (1990). Extended reductions in stereotypic behavior of students with autism through a self-management treatment package. *Journal of Applied Behavior Analysis*, 23(1), 119-127.
- Koegel, R. L., Koegel, L. K., & Carter, C. M. (1999). Pivotal teaching interactions for children with autism. *School Psychology Review*, 28(4), 576-594.
- Kogan, M. D., Blumberg, S. J., Schieve, L. A., Boyle, C. A., Perrin, J. M., Ghandour, R. M., et al. (2009). Prevalence of parent-reported diagnosis of autism spectrum disorder among children in the US, 2007. *Pediatrics*, 124(5), 1395-1403.
- Kohler, F. W. (1999). Examining the services received by young children with autism and their families: A survey of parent responses. *Focus on Autism and Other Developmental Disabilities*, 14(3), 150-158.
- Koning, C., & Magill-Evans, J. (2001). Social and language skills in adolescent boys with Asperger syndrome. *Autism*, 5(1), 23-36.

- Lee, A., Hobson, R. P., & Chiat, S. (1994). I, you, me, and autism: an experimental study. *Journal of Autism and Developmental Disorders, 24*(2), 155-176.
- Lerman, D. C., Iwata, B. A., Shore, B. A., & DeLeon, I. G. (1997). Effects of intermittent punishment on self-injurious behavior: An evaluation of schedule thinning. *Journal of Applied Behavior Analysis, 30*(2), 187-201.
- Levy, S., Kim, A., & Olive, M. L. (2006). Interventions for young children with autism: A synthesis of the literature. *Focus on Autism and Other Developmental Disabilities, 21*(1), 55-62.
- Levy, S. E., Mandell, D. S., Merhar, S., Ittenbach, R. F., & Pinto-Martin, J. A. (2003). Use of complementary and alternative medicine among children recently diagnosed with autistic spectrum disorder. *Journal of Developmental and Behavioral Pediatrics, 24*(6), 418-423.
- Lindner, J. L., & Rosen, L. A. (2006). Decoding of emotion through facial expression, prosody and verbal content in children and adolescents with Asperger's syndrome. *Journal of Autism and Developmental Disorders, 36*, 769-777.
- Loftin, R. L., Odom, S. L., & Lantz, J. F. (2008). Social interaction and repetitive motor behaviors. *Journal of Autism and Developmental Disorders, 38*(6), 1124-1135.
- Lord, C., Shulman, C., & DiLavore, P. (2004). Regression and word loss in autistic spectrum disorders. *Journal of Child Psychology and Psychiatry, 45*(5), 936-955.
- Losh, M., & Capps, L. (2003). Narrative ability in high-functioning children with autism or Asperger's syndrome. *Journal of Autism and Developmental Disorders, 33*(3), 239-251.

- Lovaas, O. I. (1987). Behavioral treatment and normal educational and intellectual functioning in young autistic children. *Journal of Consulting and Clinical Psychology, 55*(1), 3-9.
- Lovaas, O. I., Koegel, R., Simmons, J. Q., & Long, J. S. (1973). Some generalization and follow-up measures on autistic children in behavior therapy. *Journal of Applied Behavior Analysis, 6*(1), 131-165.
- Lovaas, O. I., Schreibman, L., & Koegel, R. L. (1974). A behavior modification approach to the treatment of autistic children. *Journal of Autism and Childhood Schizophrenia, 4*(2), 111-129.
- Maestro, S., Muratori, F., Cavallaro, M. C., Pecini, C., Cesari, A., Paziente, A., et al. (2005). How young children treat objects and people: an empirical study of the first year of life in autism. *Child Psychiatry and Human Development, 35*(4), 383-396.
- Mancil, G. R. (2006). Functional communication training: A review of the literature related to children with autism. *Education and Training in Developmental Disabilities, 41*(3), 213-224.
- Mansell, W., & Morris, K. (2004). A survey of parents' reactions to the diagnosis of an autistic spectrum disorder by a local service: Access to information and use of services. *Autism, 8*(4), 387-407.
- Martin, I., & McDonald, S. (2004). An exploration of causes of non-literal language problems in individuals with Asperger Syndrome. *Journal of Autism and Developmental Disorders, 34*(3), 311-328.

- Mavropoulou, S., & Padeliadu, S. (2000). Greek teachers' perceptions of autism and implications for educational practice: A preliminary analysis. *Autism, 4*(2), 173-183.
- Mayes, S. D., & Calhoun, S. L. (2003a). Ability profiles in children with autism: influence of age and IQ. *Autism, 7*(1), 65-80.
- Mayes, S. D., & Calhoun, S. L. (2003b). Analysis of WISC-III, Stanford-Binet:IV, and academic achievement test scores in children with autism. *Journal of Autism and Developmental Disorders, 33*(3), 329-341.
- Mayes, S. D., & Calhoun, S. L. (2007). Learning, attention, writing, and processing speed in typical children and children with ADHD, autism, anxiety, depression, and oppositional-defiant disorder. *Child Neuropsychology, 13*(6), 469-493.
- Mayes, S. D., & Calhoun, S. L. (2008). WISC-IV and WIAT-II profiles in children with high-functioning autism. *Journal of Autism and Developmental Disorders, 38*(3), 428-439.
- McConkey, R., Truesdale-Kennedy, M., & Cassidy, A. (2009). Mothers' recollections of early features of autism spectrum disorders. *Child and Adolescent Mental Health, 14*(1), 31-36.
- McDonough, L., Stahmer, A., Schreibman, L., & Thompson, S. J. (1997). Deficits, delays, and distractions: an evaluation of symbolic play and memory in children with autism. *Developmental Psychopathology, 9*(1), 17-41.
- McDuffie, A., Yoder, P., & Stone, W. (2005). Prelinguistic predictors of vocabulary in young children with autism spectrum disorders. *Journal of Speech, Language, and Hearing Research, 48*(5), 1080-1097.

- McEachin, J. J., Smith, T., & Lovaas, O. I. (1993). Long-term outcome for children with autism who received early intensive behavioral treatment. *American Journal of Mental Retardation, 97*(4), 359-372; discussion 373-391.
- McEvoy, R. E., Loveland, K. A., & Landry, S. H. (1988). The functions of immediate echolalia in autistic children: a developmental perspective. *Journal of Autism and Developmental Disorders, 18*(4), 657-668.
- Minschew, N. J., Goldstein, G., Taylor, H. G., & Siegel, D. J. (1994). Academic achievement in high functioning autistic individuals. *Journal of Clinical and Experimental Neuropsychology, 16*(2), 261-270.
- Mundy, P., Block, J., Delgado, C., Pomares, Y., Van Hecke, A. V., & Parlade, M. V. (2007). Individual differences and the development of joint attention in infancy. *Child Development, 78*(3), 938-954.
- Mundy, P., & Crowson, M. (1997). Joint attention and early social communication: implications for research on intervention with autism. *Journal of Autism and Developmental Disorders, 27*(6), 653-676.
- Mundy, P., & Newell, L. (2007). Attention, Joint Attention, and Social Cognition. *Current Directions in Psychological Science, 16*(5), 269-274.
- Mundy, P., Sigman, M., & Kasari, C. (1994). Joint attention, developmental level, and symptom presentation in young children with autism. *Development and Psychopathology, 6*(3), 389-401.
- Murray, D. S., Creaghead, N. A., Manning-Courtney, P., Shear, P. K., Bean, J., & Prendeville, J. (2008). The relationship between joint attention and language in

- children with autism spectrum disorders. *Focus on Autism and Other Developmental Disabilities*, 23(1), 5-14.
- Myers, S. M., & Johnson, C. P. (2007). Management of children with autism spectrum disorders. *Pediatrics*, 120(5), 1162-1182.
- Naber, F. B., Swinkels, S. H., Buitelaar, J. K., Dietz, C., van Daalen, E., Bakermans-Kranenburg, M. J., et al. (2007). Joint attention and attachment in toddlers with autism. *Journal of Abnormal Child Psychology*, 35(6), 899-911.
- National Research Council (U.S.). Committee on Educational Interventions for Children with Autism spectrum disorders. (2001). *Educating children with autism spectrum disorders*. Washington, DC: National Academy Press.
- Newman, L. (2007). Secondary school experiences of students with autism: Facts from NLTS2. NCSER 2007-305, *National Center for Special Education Research* (pp. 16).
- Osterling, J., & Dawson, G. (1994). Early recognition of children with autism: a study of first birthday home videotapes. *Journal of Autism and Developmental Disorders*, 24(3), 247-257.
- Owens, R. E. (2011). *Language development: An introduction* (8th ed.). Boston: Allyn & Bacon.
- Ozonoff, S., Strayer, D. L., McMahon, W. M., & Filloux, F. (1994). Executive function abilities in autism and Tourette syndrome: an information processing approach. *Journal of Child Psychology and Psychiatry*, 35(6), 1015-1032.
- Peters-Scheffer, N., Didden, R., Korzilius, H., & Sturmey, P. (2011). A meta-analytic study on the effectiveness of comprehensive ABA-based early intervention

- programs for children with Autism Spectrum Disorders. *Research in Autism Spectrum Disorders*, 5(1), 60-69.
- Pierce, K., & Schreibman, L. (1995). Increasing complex social behaviors in children with autism: Effects of peer-implemented pivotal response training. *Journal of Applied Behavior Analysis*, 28(3), 285-295.
- Pierce, K., & Schreibman, L. (1997a). Multiple peer use of pivotal response training to increase social behaviors of classmates with autism: results from trained and untrained peers. *Journal of Applied Behavior Analysis*, 30(1), 157-160.
- Pierce, K., & Schreibman, L. (1997b). Using peer trainers to promote social behavior in autism: Are they effective at enhancing multiple social modalities? *Focus on Autism and Other Developmental Disabilities*, 12(4), 207-218.
- Powers, M. D., Palmieri, M. J., D'Eramo, K. S., & Powers, K. M. (2011). Evidenced-based treatment of behavior excesses and deficits for individuals with autism spectrum disorders. In B. Reichow, P. Doehring, D. V. Cicchetti & F. R. Volkmar (Eds.), *Evidence-based practices and treatments for children with autism* (pp. 55-92). New York: Springer Science + Business Media.
- Prizant, B. M. (1996). Brief report: Communication, language, social, and emotional development. *Journal of Autism and Developmental Disorders*, 26(2), 173-178.
- Prizant, B. M., & Duchan, J. F. (1981). The functions of immediate echolalia in autistic children. *Journal of Speech and Hearing Disorders*, 46(3), 241-249.
- Prizant, B. M., & Rydell, P. J. (1984). Analysis of functions of delayed echolalia in autistic children. *Journal of Speech and Hearing Research*, 27(2), 183-192.

- Reichow, B., & Wolery, M. (2009). Comprehensive synthesis of early intensive behavioral interventions for young children with autism based on the UCLA young autism project model. *Journal of Autism and Developmental Disorders*, 39(1), 23-41.
- Rimland, B. (1964). *Infantile autism: The syndrome and the implications for a neural theory of autism*. New York: Appleton-Century-Crofts.
- Rinehart, N. J., Bradshaw, J. L., Moss, S. A., Brereton, A. V., & Tonge, B. J. (2001). A deficit in shifting attention present in high-functioning autism but not Asperger's disorder. *Autism*, 5(1), 67-80.
- Rogers, S. J., Hepburn, S., & Wehner, E. (2003). Parent reports of sensory symptoms in toddlers with autism and those with other developmental disorders. *Journal of Autism and Developmental Disorders*, 33(6), 631-642.
- Rogers, S. J., Hepburn, S. L., Stackhouse, T., & Wehner, E. (2003). Imitation performance in toddlers with autism and those with other developmental disorders. *Journal of Child Psychology & Psychiatry*, 44(5), 763-781.
- Rortvedt, A. K., & Miltenberger, R. G. (1994). Analysis of a high probability instructional sequence and time-out in the treatment of child noncompliance. *Journal of Applied Behavior Analysis*, 27(2), 327-330.
- Rutter, M., Bailey, A., & Lord, C. (2003). *Social Communication Questionnaire*. Los Angeles: Western Psychological Services.
- Rutter, M., Le Couteur, A., & Lord, C. (2003). *Autism Diagnostic Interview - Revised Manual*. Los Angeles: Western Psychological Services.

- Sallows, G. O., & Graupner, T. D. (2005). Intensive behavioral treatment for children with autism: four-year outcome and predictors. *American Journal on Mental Retardation, 110*(6), 417-438.
- Schreibman, L., & Ingersoll, B. (2005). Behavioral interventions to promote learning in individuals with autism. In F. R. Volkmar, R. Paul, A. Klin & D. Cohen (Eds.), *Handbook of Autism and Pervasive Developmental Disorders, Volume 2: Assessments, Interventions and Policy*. Hoboken, New Jersey: John Wiley & Sons, Inc.
- Schreibman, L., Kaneko, W., N., & Koegel, R. L. (1991). Positive affect of parents of autistic children: A comparison across two teaching techniques. *Behavior Therapy, 22*(4), 479-490.
- Schumann, C. M., Barnes, C. C., Lord, C., & Courchesne, E. (2009). Amygdala enlargement in toddlers with autism related to severity of social and communication impairments. *Biological Psychiatry, 66*(10), 942-949.
- Schwartz, I. S., Sandall, S. R., McBride, B. J., & Boulware, G. (2004). Project DATA (Developmentally Appropriate Treatment for Autism): An inclusive school-based approach to educating young children with autism. *Topics in Early Childhood Special Education, 24*(3), 156-168.
- Seltzer, M. M., Krauss, M. W., Shattuck, P. T., Orsmond, G., Swe, A., & Lord, C. (2003). The symptoms of autism spectrum disorders in adolescence and adulthood. *Journal of Autism and Developmental Disorders, 33*(6), 565-581.

- Seltzer, M. M., Shattuck, P., Abbeduto, L., & Greenberg, J. S. (2004). Trajectory of development in adolescents and adults with autism. *Mental Retardation and Developmental Disabilities Research Reviews, 10*(4), 234-247.
- Shah, K. (2001). What do medical students know about autism? *Autism, 5*(2), 127-133.
- Sigman, M., Ruskin, E., Arbeile, S., Corona, R., Dissanayake, C., Espinosa, M., et al. (1999). Continuity and change in the social competence of children with autism, Down syndrome, and developmental delays. *Monographs of the Society for Research in Child Development, 64*(1), 1-114.
- Simpson, R. L., de Boer-Ott, S. R., Griswold, D. E., Myles, B. S., Byrd, S. E., Ganz, J. B., et al. (2005). *Autism spectrum disorders: Interventions and treatments for children and youth*. Thousand Oaks, CA: Corwin Press.
- Skinner, B. F. (1992). *Verbal Behavior*. Acton, MA: Copley Publishing Group.
- Skokut, M., Robinson, S., Openden, D., & Jimerson, S. R. (2008). Promoting the social and cognitive competence of children with autism: Interventions at school. *The California School Psychologist, 13*, 93-108.
- Smith, T., & Antolovich, M. (2000). Parental perceptions of supplemental interventions received by young children with autism in intensive behavior analytic treatment. *Behavioral Interventions, 15*(2), 83-97.
- Soorya, L. V., Carpenter, L. A., & Romanczyk, R. G. (2011). Applied behavior analysis. In E. Hollander, A. Kolevzon & J. T. Coyle (Eds.), *Textbook of autism spectrum disorders* (pp. 525-535). Arlington, VA: American Psychiatric Publishing, Inc.

- Stahmer, A. C. (1995). Teaching symbolic play skills to children with autism using pivotal response training. *Journal of Autism and Developmental Disorders*, 25(2), 123-141.
- Stolber, K. C., Gettinger, M., & Goetz, D. (1998). Exploring factors influencing parents' and early childhood practitioners' beliefs about inclusion. *Early Childhood Research Quarterly*, 13(1), 107-124.
- Stone, W. L., & Yoder, P. J. (2001). Predicting spoken language level in children with autism spectrum disorders. *Autism*, 5(4), 341-361.
- Sulzer-Azaroff, B., Hoffman, A. O., Horton, C. B., Bondy, A., & Frost, L. (2009). The picture exchange communication system (PECS): What do the data say? *Focus on Autism and Other Developmental Disabilities*, 24(2), 89-103.
- Sundberg, C. T., & Sundberg, M. L. (1990). Comparing topography-based verbal behavior with stimulus selection-based verbal behavior. *The Analysis of Verbal Behavior*, 8, 31-41.
- Sundberg, M. L., & Michael, J. (2001). The benefits of Skinner's analysis of verbal behavior for children with autism. *Behavior Modification*, 25(5), 698-724.
- Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed.). Boston: Pearson Education, Inc.
- Tager-Flusberg, H. (1995). Once upon a rabbit: Stories narrated by autistic children. *British Journal of Developmental Psychology*, 13(1), 45-49.
- Tager-Flusberg, H. (1996). Brief report: current theory and research on language and communication in autism. *Journal of Autism and Developmental Disorders*, 26(2), 169-172.

- Tager-Flusberg, H., & Calkins, S. (1990). Does imitation facilitate the acquisition of grammar? Evidence from a study of autistic, Down's syndrome and normal children. *Journal of Child Language*, *17*(3), 591-606.
- Tager-Flusberg, H., Calkins, S., Nolin, T., Baumberger, T., Anderson, M., & Chadwick-Dias, A. (1990). A longitudinal study of language acquisition in autistic and Down syndrome children. *Journal of Autism and Developmental Disorders*, *20*(1), 1-21.
- Taylor, B. A., & Harris, S. L. (1995). Teaching children with autism to seek information: acquisition of novel information and generalization of responding. *Journal of Applied Behavior Analysis*, *28*(1), 3-14.
- Tincani, M. (2004). Comparing the picture exchange communication system and sign language training for children with autism. *Focus on Autism and Other Developmental Disabilities*, *19*(3), 152-163.
- Tsatsanis, K. D. (2004). Heterogeneity in learning style in Asperger syndrome and high-functioning autism. *Topics in Language Disorders*, *24*(4), 260-270.
- Turner, M. (1999). Annotation: Repetitive behaviour in autism: a review of psychological research. *Journal of Child Psychology and Psychiatry*, *40*(6), 839-849.
- Tustin, F. (1994). The perpetuation of an error. *The Journal of Child Psychotherapy*, *20*(1), 3-23.
- Valentino, A. L., & Shillingsburg, M. A. (2011). Acquisition of mands, tacts, and intraverbals through sign exposure in an individual with autism. *Analysis of Verbal Behavior*, *27*(1), 95-101.

- Van Lancker, D., Cornelius, C., & Needleman, R. (1991). Comprehension of verbal terms for emotions in normal, autistic, and schizophrenic children. *Developmental Neuropsychology, 7*(1), 1-18.
- Virues-Ortega, J. (2010). Applied behavior analytic intervention for autism in early childhood: Meta-analysis, meta-regression and dose-response meta-analysis of multiple outcomes. *Clinical Psychology Review, 30*(4), 387-399.
- Vismara, L. A., & Rogers, S. J. (2010). Behavioral treatments in autism spectrum disorder: what do we know? *Annual Reviews in Clinical Psychology, 6*, 447-468.
- Volkmar, F. R., & Klin, A. (2005). Issues in the classification of autism and related conditions. In F. R. Volkmar, R. Paul, A. Klin & D. Cohen (Eds.), *Handbook of autism and pervasive developmental disorders* (Vol. 1). Hoboken, NJ: John Wiley & Sons, Inc.
- Wahler, R. G., & Fox, J. J. (1980). Solitary toy play and time out: A family treatment package for children with aggressive and oppositional behavior. *Journal of Applied Behavior Analysis, 13*(1), 23-39.
- Walker-Kennedy, S. (1988). Autism from a Freudian and a Kleinian point of view. *The Journal of the Melanie Klein Society, 6*(1), 35-57.
- Werner, E., Dawson, G., Osterling, J., & Dinno, N. (2000). Brief report: Recognition of autism spectrum disorder before one year of age: a retrospective study based on home videotapes. *Journal of Autism and Developmental Disorders, 30*(2), 157-162.
- Whalen, C., Schreibman, L., & Ingersoll, B. (2006). The collateral effects of joint attention training on social initiations, positive affect, imitation, and spontaneous

- speech for young children with autism. *Journal of Autism and Developmental Disorders*, 36, 655-664.
- Whitaker, R. (2002). Supporting families of preschool children with autism. *Autism*, 6, 411-426.
- Wiggins, L. D., Baio, J., & Rice, C. (2006). Examination of the time between first evaluation and first autism spectrum diagnosis in a population-based sample. *Journal of Developmental and Behavioral Pediatrics*, 27(2 Suppl), S79-87.
- Yeargin-Allsopp, M., Rice, C., Karapurkar, T., Doernberg, N., Boyle, C., & Murphy, C. (2003). Prevalence of autism in a US metropolitan area. *Journal of the American Medical Association*, 289(1), 49-55.
- Yianni-Coudurier, C., Darrou, C., Lenoir, P., Verrecchia, B., Assouline, B., Ledesert, B., et al. (2008). What clinical characteristics of children with autism influence their inclusion in regular classrooms? *Journal of Intellectual and Disability Research*, 52(10), 855-863.
- Young, R. L., Brewer, N., & Pattison, C. (2003). Parental identification of early behavioural abnormalities in children with autistic disorder. *Autism*, 7(2), 125-143.
- Ziatas, K., Durkin, K., & Pratt, C. (1998). Belief term development in children with autism, Asperger syndrome, specific language impairment, and normal development: links to theory of mind development. *Journal of Child Psychology and Psychiatry*, 39(5), 755-763.

Ziatas, K., Durkin, K., & Pratt, C. (2003). Differences in assertive speech acts produced by children with autism, Asperger syndrome, specific language impairment, and normal development. *Developmental Psychopathology, 15*(1), 73-94.