ABSTRACT

MCKEITHAN, GLENNDA KASHNER. Interventions Employed in Regular Education Settings for Secondary Students with High Functioning Autism: A Meta-Analysis. (Under the direction of Dr. Susan Osborne and Dr. Ed Sabornie)

An increase has occurred in the number of students identified as having high functioning autism (HFA), who are being served in the regular education setting with their non-disabled peers. Many of these students have difficulty with academic and social expectations in this setting, and a minimal amount of information is available to educators related to meeting the needs of these students in secondary educational settings. Researchers must identify effective, researched-based interventions to help adolescent students with HFA meet academic and social milestones. This information helps key stakeholders make informed decisions about service delivery and instructional support that maximizes the potential for student success (McLaughlin & Rafferty, 2014). This study entailed an extensive search of the research related to students with HFA and identified 23 studies employing single case research design (SCD) published in peer-reviewed journals between 1985 and 2015. An analysis was completed to compare results from different studies to evaluate effect size, patterns, and relationships related to interventions designed to improve behavior and academic outcomes for adolescent students with HFA placed in regular education settings. A disaggregation analysis indicated interventions to improve learning in academic and content knowledge, curriculum assistance and social and/or behavioral skills can be used effectively with students with HFA participating in regular education. However, more information is needed related to specific strategies which may prove useful for these students within this age range and setting.

Keywords: HFA, High Functioning Autism, Asperger’s Syndrome, adolescents, ASD, autism, public school setting, regular education, best practices, strategies, interventions, meta-analysis
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by:

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DEDICATION

This is dedicated to three people who sacrificed much to help me achieve this goal. First, to the memory of my mother, Candace Kashner, who encouraged me to begin this process and believed I could actually do it! Next, to my husband, Michael McKeithan, who has been at my side and willing to do whatever I needed to help me finish each one of my degrees and other professional projects and commitments over the years. Finally, to my advisor and professor, Dr. Douglas Cullinan. I may not have become a teacher if he had not offered me a graduate assistant position in 1995, and I would not have considered pursuing my doctoral degree if he had not offered me an opportunity to teach as an adjunct and encouraged me to apply to the program. There are no adequate words to acknowledge my sincere appreciation of their sacrifices and efforts on my behalf over the years.
BIOGRAPHY

Glennda Kashner McKeithan was born in California on September 15, 1965. Her father was a US Marine which enabled her to experience life in many different areas of the United States. She met and married her husband, Michael McKeithan, when she was an undergraduate at North Carolina State University in 1987. She received her Bachelor of English in 1992 and her Master of Education in 1995. Mrs. McKeithan has worked as a regular and special education teacher in middle and high school settings since 1989. She has worked as an adjunct instructor for three institutions of higher learning since 2008. Mrs. McKeithan entered the doctoral program in Curriculum and Instruction at North Carolina State University in 2012. Her research interests include effective intervention techniques for students with high functioning autism, instructional coaching and the practical application of evidence based interventions in regular education settings.
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CHAPTER 1: INTRODUCTION

Background

Many challenges face American students with disabilities as they strive to master curriculum objectives and develop the academic and social skills needed to achieve their personal goals and assume their roles as productive, contributing adult citizens. This is especially difficult for students with autism who have the intellectual ability to learn the academic curriculum content, but the characteristics of their disability may significantly impair their ability to reach their full potential throughout their academic careers and adult lives. In order to fully understand the significance of this issue, it is important to first define this disorder, and identify the unique challenges facing those with this disability in educational settings.

Definition of ASD

Autism or autism spectrum disorder (ASD) is a multifaceted neurological impairment which includes a wide range of symptoms, skills, and levels of deficiencies related to social communication and interaction across multiple settings (Simpson & Smith-Myles, 2011). Individuals with ASD are described as being “on a spectrum” because significant differences exist in the levels of impairments, ranging from mild to severe (Simpson & Smith-Myles, 2011). Moreover, individuals with ASD manifest the defining characteristics and the other impairments in different ways and combinations.

Diagnosing ASD

Two methods are used to diagnose individuals with ASD. The general definition of ASD noted above includes individuals diagnosed using the educational definition and/or the clinical definition of ASD. The most specific and objective definition of ASD is outlined in the Diagnostic and Statistical Manual of Mental Disorders, fifth edition -DSM 5. This manual is used by medical professionals to clinically diagnose ASD (American Psychiatric Association,
Clinical definition. DSM 5 defines ASD as a complex neurodevelopmental disorder characterized by consistent difficulty with verbal and nonverbal social communication skills (American Psychiatric Association, 2013). The DSM is a living document that has changed several times over the last few decades to reflect new research and ongoing psychiatric practice. Changes are made to improve the accuracy of the diagnoses and to allow clinicians the ability to describe specific symptoms. Persons diagnosed with ASD must show persistent deficits in two domains. These include persistent social communication and social deficits, and restricted and repetitive patterns of behavior.

DSM 5 criteria. According to DSM 5, individuals with ASD must demonstrate (either in the past or in the present) deficits in social-emotional reciprocity, deficits in nonverbal communicative behaviors used for social interaction, and deficits in developing maintaining and understanding relationships (American Psychiatric Association, 2013). In addition, they must show at least two types of repetitive patterns of behavior, such as repetitive motor movements, insistence on sameness, inflexible adherence to routines, fixated interests, hyper reactivity to sensory input, and/or unusual interest in sensory aspects of the environment. Under DSM 5, clinicians rate the severity of deficits based on the level of support they require (American Psychiatric Association, 2013).

Comparison of DSM 5 and DSM 4 systems. DSM 5 eliminates separate subcategories of autism including Asperger syndrome, PDD-NOS (Pervasive Developmental Disorder –Not Otherwise Specified), childhood disintegrative disorder, and autistic disorder. However, individuals previously diagnosed on the autism spectrum, including those with Asperger syndrome or PDD-NOS, do not lose their ASD diagnosis. Previously, three domains of
symptoms (social impairment, language/communication impairment and repetitive/restricted behaviors) were recognized, and DSM 4 required individuals to exhibit at least six of twelve deficits in social interaction, communication or repetitive behaviors (American Psychiatric Association, 2013).

**Other changes.** DSM 5 requires a person to exhibit three deficits in social communication and at least two symptoms in the category of restricted range of activities/repetitive behaviors. A new symptom is now included: hyper- or hypo-reactivity to sensory input or unusual interests in sensory aspects of the environment, and symptoms can be current or reported in past history. In addition, a new category called Social Communication Disorder is included to allow for a diagnosis of disabilities in social communication without the presence of repetitive behavior. While the educational diagnosis of ASD is somewhat more subjective, the basic characteristics are similar (see Table 1).

**Educational definition.** The federal law on special education, Individuals with Disabilities Education Improvement Act (2004), describes several educational disability conditions by which a student may qualify for special education. One of these conditions is Autism. It is defined in Individuals with Disabilities Education Act (IDEA) as follows:

(i) Autism means a developmental disability significantly affecting verbal and nonverbal communication and social interaction, regularly evident before age three, which adversely affects a child's educational performance. Other characteristics often associated with autism are engagement in repetitive activities and stereotyped movements, resistance to environmental change or change in daily routines, and unusual responses to sensory experiences.

(ii) Autism does not apply if a child's educational performance is adversely affected
primarily because the child has an emotional disturbance, as defined in paragraph (c) (4) of this section. A child who manifests the characteristics of autism after age three could be identified as having autism if the criteria in paragraph (c) (1) (i) of this section are satisfied.

**Identification procedures.** In order to make an educational diagnosis, a school-based IEP team determines if the student is eligible for special education services under the ASD classification within the school context. The core behaviors analyzed by the school team are similar to those outlined in DSM 5 (e.g., difficulties with social interaction, communication, and repetitive behaviors). The multidisciplinary team considers assessments and data from multiple sources to evaluate the student’s social behavior, communication, adaptive behavior, motor skills and cognitive ability in order for them to determine eligibility. While all students on the spectrum can be diagnosed with autism via the educational definition (regardless of intellectual ability), a correlation exists between age of diagnosis and method of diagnosis (Shattuck, 2006). This is an important correlation because many students on the higher end of the spectrum are not diagnosed until they are older.

**Factors Contributing to Diagnosis**

**Age of diagnosis.** Students with severe social, communication and cognitive needs are often identified when they are younger because their symptoms are more pronounced, and they do not make expected progress with age-specific developmental milestones. The average age of ASD diagnosis for students with severe deficits is 3.1 years. In the more severe manifestations, for example, a child may have limited or no verbal communication skills, exhibit odd behavior, engage in aggressive or self-injurious behavior, and have severe intellectual deficits. Such a child might be characterized as “low-functioning.” In contrast, the average age of ASD diagnosis for
students with higher cognitive abilities is 7.2 years (Mandell, Novak, & Zubritsky, 2005).

**Behavior in school settings.** Students on the higher end of the ASD spectrum may not be identified until after they start school when communication and socialization skill deficits become more apparent as they interact with peers. This is because a student on the mild end of the ASD spectrum (with average or above average cognitive abilities) may not exhibit serious social and communication deficits until after they are expected to interact with others in unfamiliar environments on a consistent basis.

In these instances, students with less severe manifestations may be socially awkward, not make eye contact, exhibit odd behaviors, and they may have difficulty making friends, asking for help, or advocating for themselves. Such a child might be characterized as “high-functioning.” *Low-functioning and high-functioning* are informal terms that communicate only the approximate degree of impairment and extent of support needed that might characterize a person with ASD.

Although students with *High Functioning Autism* (HFA) may exhibit less severe degrees of impairment, their deficits can handicap their personal and social functioning. The current study presents a few of the ways that students with HFA experience problems with common situations, including school situations. As many of these students identified using the educational definition have higher cognitive abilities, it is important to define HFA and the challenges these students may experience in the secondary educational setting.

**High Functioning Autism**

HFA is an informal term often referring to students with social and communication deficits associated with ASD together with at least average intelligence, or placement in regular education classes, or both (Gibson, Adams, Lockton, & Green, 2013). Students with HFA who are enrolled in regular education classes often experience difficulty with academic and social
success in school (Wheeler, Mayton, & Carter, 2015). Students with ASD have both receptive and expressive language deficits which result in many common problems or potential obstacles to success in school. This has become a serious issue because the prevalence of students being identified with this disability has significantly increased over the past few decades (Centers for Disease Control, 2014).

**Prevalence of Students with ASD.** The Centers for Disease Control (CDC) has identified a consistent 10-17% increase in annual growth of children identified with ASD. In 2014, the CDC released new statistics on the prevalence of children with ASD in the United States indicating that 1 in 68 children (1:42 boys and 1:189 girls) have ASD. The National Center for Education Statistics (NCES) reports that children with ASD represent eight percent of students with exceptionalities. The number identified as HFA is approximately 1 in 100 children (Baio, 2012; Home, 2014; Simpson & Smith-Myles, 2011).

**Students with HFA.** The prevalence of students with ASD who could be categorized as high functioning varies. The CDC estimates only 31% of students with ASD have intellectual disabilities with IQ scores less than 70, and between 43-69% of students with ASD have at least average intelligence (Campbell, 2003; Fombonne, 2005; Honda, Schimizu, Misumi, Niimi, & Ohashi, 1996; Kielimen, Linna, & Moilanen, 2000). Home (2014) reports that approximately 69% of students with ASD have IQ scores higher than 70; forty-six percent have IQ scores above 85. The increase in students being identified with ASD has resulted in an increase in the number of these students served in the public school setting.

**Public school enrollment.** The increase in prevalence of ASD among children corresponds to an increase in the number of children identified with ASD in school settings. The National Center for Education Statistics data indicates an increase in public school enrollment of
students with autism from 44,874 in 1998-99 to 304,080 in 2008-09 (de Bruin, Deppeler, Moore, & Diamond, 2013).

**Federal requirements.** IDEA mandates that these children be included in the Least Restrictive Educational Environment (LRE). In most instances, due in large part to the inclusion movement in special education and the need for responsible, data-based decision making, students with the intellectual ability to master academic content are included in regular education classrooms, and they are taught by highly qualified, regular education teachers certified in the course content (Kauffman & Badar, 2014). For the purposes of this study, a student with HFA is defined as a student identified as eligible for special education services in the category of autism and enrolled in at least one regular education class.

**Inclusion**

The provision of an appropriate educational setting is vital to student success. Although the number of students with HFA served in regular education settings has increased, these students often demonstrate learning and behavior deficits (Hundert, 2009; Lindsay, Proulx, Thomson, & Scott, 2013) because they are expected to meet the same academic demands (regular education curriculum, graduation requirements and standardized test requirements) as their non-disabled peers. IDEA requires that public schools include students with disabilities in standardized assessments. The requirement for them to meet these academic milestones has resulted in an increase in the number of studies related to strategies and interventions that address the needs of students with ASD.

It is easier to determine appropriate educational placement for students on the lower end rather than the higher end of the ASD spectrum because students on the lower end do not often have the ability to meet academic demands. Therefore, the need for intense support from
multiple providers in the school, home and community is more obvious. On the other hand, students with HFA on the higher end of the spectrum are more difficult to serve because they have the intellectual ability to understand academic content. Therefore, it is difficult to justify more restrictive academic environments or intensive support systems designed to meet their needs in secondary settings because the needs of these students are not as apparent.

**Reduced support.** IEP teams often provide services in the LRE (inclusion settings), but this placement can be especially difficult for students with HFA because as the students’ progress in their educational careers, rigid graduation requirements and curriculum demands result in fewer opportunities in a student’s schedule to be removed from regular education classes. Consequently, special education teachers are lacking in most middle and high schools. Therefore, direct special education support in regular education classes often decreases in secondary settings, and most regular education teachers are unprepared to meet the academic and social needs of this unique group of students (Hewitt, 1999).

**Unprepared teachers.** Regular education inclusion teachers are expected to teach all students curriculum content and require students to communicate understanding and apply new learning effectively by engaging in academic discourse and problem solving through social interactions with others. The ability to communicate, work cooperatively with others and problem solve are vital skills students need in the world of work and adult relationships. Teachers without training in how to address the needs of students with deficits in communication and social interaction have a difficult time creating a learning environment which makes students with HFA feel welcome and helps them develop the self-reliance skills needed for success in the classroom as well as in life. Educators in regular education classrooms are expected to plan and deliver instruction to meet the needs of all students. Unfortunately, most of these teachers do not
have the background and/or training to create a truly inclusive classroom (Hewitt, 1999).

**Barriers to success.** The lack of available information related to how to meet the needs of adolescent students with HFA is a concern because research indicates increased anxiety among students with higher cognitive functioning (IQ > 70 – average two standard deviations from the mean) diagnosed with ASD. In fact, evidence suggests that these students experience more depression and anxiety-induced physical and/or verbal tics in the educational setting (White, Oswald, Ollendick, & Scahill, 2009). Unfortunately, budget restrictions, larger class sizes, the demand for accountability (teacher/school), as well as the number of students with varied disabilities included in regular education classes, can become barriers to student success.

These challenges, in conjunction with limited teacher awareness of how to address student needs, make it difficult for students with HFA to be successful. In order to better understand the rationale behind the existing research related to interventions for students with HFA in regular education settings, it is important to understand the common academic, social and communication problems often exhibited by students with HFA in secondary inclusion settings.

**Common Problems**

**Common Academic Problems in Secondary Settings**

**Ability to learn.** Although adolescent students with HFA may have the intellectual ability to learn regular education content, the cognitive ability to learn in inclusive settings can become a significant obstacle to student success. This is because the ability to comprehend and think deeply about topics of study is vitally linked to understanding key concepts and the practical application of newly learned information. This skill set (higher order thinking and practical application of knowledge) requires students to consider new ideas from many different
viewpoints and abstract scenarios. Regular education classrooms in the secondary settings require students to engage in academic discussion, participate in group work, and debate with peers to enhance their abilities to communicate with others (Drake, 2012). Unfortunately, many students with HFA are challenged to effectively consider alternative perspectives, understand abstract concepts and communicate new learning at the same pace and in the same manner as their non-disabled peers.

Expressive and receptive language deficits. Students with ASD have both expressive and receptive language deficits. Expressive language difficulties experienced by students with ASD include problems with vocabulary, complex sentences and remembering words. Receptive language skills enable people to understand or comprehend language heard or read. Students with deficits in this area may have difficulty being able to put thoughts into words and/or sentences together in a way that makes sense; they may struggle with oral language, organized writing and application of basic grammar concepts (Lindsay, Proulx, Thomson, & Scott, 2013).

The hidden curriculum. Success in the regular education setting may be difficult for these students if they have problems making inferences, comparing and contrasting abstract ideas, understanding figurative language, and navigating the hidden curriculum of schools in which students are required to connect individual responses with the appropriate social context such as knowing the difference between speaking to a peer and to an authority figure and considering other perspectives (Lindsay, Proulx, Thomson, & Scott, 2013).

Common Social and Communication Problems

Adolescent psychosocial development. The development of social relationships and communication skills is important to adolescent students with ASD in school settings as they develop intellectual and personality characteristics. Self-esteem and self-confidence are linked to
positive interactions with others. Students with HFA must use information gained from their five senses (what they see, hear, etc.) to further explore abstract ideas and test hypotheses. This is because learning is a social process and cannot occur without interaction (student/teacher and student/student). Social and communication skills are needed to help students think logically, develop critical thinking skills, and problem solve as they interact with others and progress through their school careers towards greater independence (Cleveland Clinic, 2014).

**Interacting with others.** Peer acceptance is an important part of psychosocial development during adolescence. Students with autism often have difficulty establishing and maintaining satisfactory peer relationships because they may exhibit unusual behavior such as: robotic and/or formal speech, awkward social skills, making irrelevant comments, demonstrating unusual and/or repetitive gestures, over sensitivity to sensory stimulation in the school, and immature problem solving skills. Many of these students are interested in developing social relationships with peers, but they lack the communication skills to engage in age-expected social interactions (Simpson & Smith-Myles, 2011).

**Communication deficits.** Students with HFA may lack the communication skills needed to engage in age-appropriate academic and social interactions with others and meet the demands of the regular education setting because their deficits may not be obvious to teachers and peers. These students may appear to be inconsiderate, argumentative, intolerant and egocentric. Their unusual behaviors and inadequate social skills can lead to isolation and reduce their opportunities to develop age-appropriate social interaction skills.

**Social relationships.** Students with HFA have difficulty establishing and maintaining social relationships with others. Delays in expressive and receptive language skills can make it a challenge for them to initiate or sustain conversations. These deficits have the potential to
adversely impact their ability to establish social relationships, make academic progress, and develop skills needed for successful occupational performance (American Psychiatric Association, 2013).

Although most students with HFA violate social norms and expectations without understanding why or what alternative behavior would be more appropriate, these deficits are often more pronounced in the secondary setting. Students with HFA may have unusual stereotypical and restricted patterns of interest and behavior which keep them from developing the social norms needed in school and in the larger community. Marriage, Wolverton, and Marriage (2009) reported that only 15-20% of students with HFA leaving secondary education have the social skills needed to successfully participate in post-secondary education and employment.

Regular education teachers, especially at the secondary school level, must successfully facilitate the academic and social transition through adolescence into adulthood so students are prepared to meet the challenges of post-secondary life. While this is important for all students, it is especially important for students with HFA. These potential differences become more pronounced as students fail to develop skills needed for independence in academic settings which could lead to long term consequences for students with HFA. These consequences are the underlying purpose for this current study. According to recent research (Bennett & Dukes, 2013; Bishop-Fitzpatrick, Minshew, & Eack, 2013; McLaughlin & Rafferty, 2014), current service delivery models are not consistently meeting the needs of these adolescents with HFA, which means they are not leaving school prepared to transition into the world of work and adult relationships.
Long Term Consequences

School failure. When school-based interventions are not effective, the learning environment is not conducive to student needs. This contributes to school failure and/or an increase in the dropout rate (Bennett & Dukes, 2013; Bishop-Fitzpatrick, Minshew, & Eack, 2013; McLaughlin & Rafferty, 2014). The No Child Left Behind (NCLB) Act obligates schools to report achievement data of students with disabilities into subgroups as evidence that students are making adequate yearly progress (2002). Evidence from standardized assessment results and other post school outcome measures indicate students with ASD are not making satisfactory progress.

Unmet personal goals. Marriage, Wolverton, and Marriage reported that only 15-20% of students with HFA participate in post-secondary education and employment (2009). Educators must address this issue for obvious ethical issues -- students with ASD deserve to live happy and fulfilled lives, so it is important for them to learn the skills they need to achieve their personal goals and aspirations. However, financial incentives are also a consideration. In 2012, services for post-secondary support for students with ASD was $126 billion dollars a year; this number is triple the 2006 costs. The lifetime cost of individuals with ASD and no intellectual disabilities was $1.4 million in addition to the costs that would accrue with a non-disabled peers (Buescher, Cidav, Knapp, & Mandell, 2014; Center for Disease Control and Prevention, 2014).

Economic consequences. Medical expenses for individuals with ASD are 4-6 times greater than expenses for students with intellectual disabilities. Recent data from the CDC reports costs of $17,000-$21,000 per year to care for individuals with ASD in comparison to individuals without ASD. Behavioral Interventions for students with ASD range from $40,000-$60,000 per year per individual (Center for Disease Control and Prevention, 2014; Garcia-
Villamisar, Wehman, & Navarro, 2002; Targett & Wehman, 2009).

**Unprepared for life.** Adult employment, independent living, and social outcomes for these students are poor. Students with ASD have a difficult time understanding the nuances of effective communication skills and fitting in with people and environments in academic and social situations. Such needs must be addressed in order for them to develop basic skills needed for success in school as well as in post-secondary settings. Many individuals with HFA have immature skills related to the give-and-take of social interactions and limited understanding of body language or facial expressions. Some may have a desire to establish meaningful relationships, and others may not be motivated to engage in social interactions. In either case, students with HFA are less likely to learn incidental social interaction skills than their non-disabled peers (American Federation of Teachers, 2014), but these skills are directly related to long term student success.

**Post-school outcomes.** Persons with HFA are more likely to depend on support from relatives or live in residential placements. They are less likely to gain full time employment or live independently. Research indicates this is not necessarily because it is not possible for these students to be independent, but rather because they are not leaving school with the skills they need to obtain and retain full time employment. They lack adaptive living and problem solving skills needed for independent living (Ballaban-Gil, Rapin, Tuchman, & Shinnar, 1996; Cameto, Levine, & Wagner, 2004; Cederlund, Hagberg, Billstedt, Gillberg, & Gillberg, 2008; Hendricks & Wehman, 2009; Hurlbutt & Chalmers, 2004; Tsatsanis, Foley, & Donehower, 2004).

**Significance of the Current Study**

The current study synthesizes empirical evidence found in relevant published studies on interventions used with students who have HFA in secondary school settings. Results can
provide a basis for selecting appropriate interventions to address the academic and/or social needs of adolescent students with HFA in regular education classrooms and potentially improve educational outcomes for students with HFA. This study adds to educator’s knowledge of the overall value of interventions for secondary students with HFA in regular education settings. In addition, gaps in the existing literature are noted as interventions with little or no research can help identify areas of additional need.

**Chapter Summary**

The demand for accountability and responsible use of public funds to address the true needs of students with disabilities so they can successfully transition to adulthood has become a significant challenge for educators who work with students with HFA. The current study adds to the available research on the effectiveness of interventions used with these students. Chapter two of this manuscript provides an overview of the currently available literature related to this issue as well as a discussion of problems cited in the literature, trends in social science research and an explanation of the procedures used in this meta-analysis. In Chapter three research design and methodology used in this study are described in detail. In Chapter four, results are presented and analyzed. Chapter five offers a discussion of research findings and their implications.
CHAPTER 2: REVIEW OF THE LITERATURE

Existing Literature

Current Focus

Studies of research-based interventions related to meeting the needs of adolescent students with HFA in regular education settings are limited in both the quantitative and qualitative realms. The majority of available research is concentrated on the needs of students in pre-school and elementary settings with severe cognitive and social/communication needs in more restrictive settings (special education classes or alternative educational placements). While some of the interventions and/or strategies noted in this research base may be applicable to older students in less restrictive settings, it is just as likely that the research may not be appropriate for students without cognitive deficits in less restrictive settings. Much of the existing research lacks information related to positive, long term effects (success rate and/or the ability to generalize/retain learning) and practical application to regular education environments (Kasari & Smith, 2013).

Additional research needed. Identifying realistic, research-based interventions that regular education teachers can apply in their classrooms would help offer students with HFA equal access to the same educational opportunities as their non-disabled peers. Educators and others involved in service delivery need access to this information in order to make informed decisions about how to support these students and maximize their potential (McLaughlin & Rafferty, 2014).

Interventions for Students with HFA

Problems cited in literature. The existing knowledge base indicates students with HFA in regular education settings often experience difficulty learning in an inclusion setting. This may
be because these settings require them to interact with others, independently recognize and follow class routines, self-regulate, and communicate effectively with others (Hundert, 2009). Much of the available research is focused on interventions designed to address specific characteristics/needs of individual students and/or small groups (Virues-Ortega, Julio, & Pastor-Barriuso, 2013).

**Common interventions.** Common public school-based interventions include antecedent manipulation, consequence-based interventions, self-management interventions, and video-based interventions (de Bruin, et al, 2013). Although the number of primary and secondary research studies has increased in recent years, educational researchers have been exploring ways to effectively address the social and academic skill deficits of students with ASD for more than a century (Colter, 1945; Daniel, 1908).

**Primary Research Designs**

To provide background to the method detailed in chapter three, this chapter reviews characteristics of primary research (original collection and analysis of data) and secondary research (summary or synthesis of existing research) as well as research designs cited in the existing literature base. Two primary research designs used by investigators are group comparison experimental designs and single case research designs (Wery, 2012).

**Group comparison research designs.** In group comparison designs, investigators use the experimental method to manipulate variables in a controlled testing environment to identify and explore statistically significant causal relationships between the experimental group and the control group. In addition, intervention effectiveness is based on the average of the group rather than on individual progress (Engel & Schutt, 2012; Kazdin, 2011; Yin, 2013). Unfortunately, these group studies are difficult to replicate in the school setting for several reasons. Finding
large, homogeneous subject groups, random group assignments and standardized treatment can be problematic in settings where intervention is needed for only one student or a small group of students. The practical application in non-clinical, real life settings is often not realistic and/or possible.

Comparison designs and students with ASD. Few experimental studies of interventions for children with ASD have used group comparison designs. ASD was and remains too infrequently diagnosed to obtain reasonably-sized samples of students with ASD. Most experimental research on school interventions for students with ASD utilize an approach called applied behavior analysis, in which at least one behavior is reliably measured repeatedly over time, and the experimenter must demonstrate that changes he or she makes in an independent variable (intervention) cause predictable changes in a dependent variable (behavior).

The form of experimental design in the applied behavior analysis approach is called by various names, including within subject design, intra-subject replication design, single-subject design, and single case design. In this current study, only single case design (SCD) research studies are considered. Single-case or single subject research design is an alternative research design to between group designs.

Single-case research design. Unlike comparison group designs, the focus of SCD is on one single subject (N=1), however, the “one” subject can include a single individual or a group of individuals. This term is widely used, although it can be argued that the term is misleading because only some SCD research is concerned with the behavior of a single subject. This research is more practical in psychology, education, and human behavior because rather than comparing the subject to another group, the subject serves as his or her own control group. The primary advantage of SCD is the ability of or freedom for researchers to evaluate interventions
with individual or small groups of participants in realistic settings (Kazdin, 2011).

Although the SCD research environment may be more practical than the clinical setting of between group designs, SCD requires a methodological implementation to enhance the likelihood of an objective assessment of intervention effectiveness. As is the case with empirical studies, the SCD researcher identifies a dependent variable (target behavior) and an independent variable (intervention). Researchers then plan and analyze steps to objectively introduce, integrate, and evaluate intervention effectiveness before, during, and after the intervention. Researchers must consider assessment strategies, methods for evaluating inter-observer agreement and data evaluation (Engel & Schutt, 2012; Kazdin, 2011).

The four main forms of SCD are: withdrawal (also called reversal) design, multiple-baseline design, changing criterion design, and multiple treatment design (Cooper, Heron, & Heward, 2009; Kazdin, 2011). Each form has its variations.

**Withdrawal designs.** Withdrawal or AB research designs are composed of at least two phases: Phase “A” or baseline phase which document no intervention or treatment followed by the intervention or treatment, Phase “B.” Additional interventions or changes in interventions can be included in subsequent phases (Phase C, Phase D, etc.). Continuous assessments or repeated observations of performance over time are recorded. If a change is noted, then the treatment has an effect on the behavior of interest. This research design includes many variations (ABA, ABAB, BABA, ABCBCA, ABCABC) which can help to control for alternative hypotheses. In this variation, if the behavior returns to baseline measurement when treatment is withdrawn and subsequently demonstrates the desired effect when treatment is reapplied, the results can be interpreted with more confidence in predicting future behavior.

The disadvantages of this design include threats to internal validity that might account for
change in one of the phases, the possible absence of behavior reversal and possible ethical consequences of reversing behavior (Kazdin, 2011). An alternative research design that does not require a return to baseline phase is the multiple baseline design.

**Multiple baseline designs.** Multiple baseline designs allow researchers to demonstrate the effects of introducing an intervention to baselines across behaviors, participants, situations, and settings at different points in time. The advantage of this design is that the intervention does not need to be withdrawn after it is introduced, and the design can be used with multiple baselines (typically three or more). The disadvantages of this design are related to possible uncertainties of baseline changes being interdependent, inconsistent intervention effects, and the potential effects of prolonged baselines. Changing criterion research designs can help to address some of the concerns (Kazdin, 2011).

**Changing criterion designs.** Changing criterion designs demonstrate the effect of intervention by showing performance changes at several points during the intervention phase as conditions change during intervention. A clearly apparent effect appears if performance follows changing criterion. Variations of this design include the ability to make criterion increasingly more or less severe. This design can incorporate the use of a brief reversal phase to demonstrate increases or decreases in effect depending on criterion, and the amount of change, as well as the number and duration of phases, can be adjusted. Disadvantages of this design include the possibility of performance not following changes in criterion, rapid changes in performance and deciding when to change criteria, and making inferences about whether performance and criteria demonstrate causal relationships (Kazdin, 2011). Multiple treatment research designs also help to measure treatment effect before and after intervention.

**Multiple treatment designs.** Multiple treatment designs are used to compare two or
more treatments in order to evaluate the effectiveness of alternative interventions and/or conditions administered to the same subject/group. Each intervention administered is associated with a particular stimulus, and the purpose of the design is to demonstrate that a given stimulus exerts control of performance. Variations of the design include alternating treatments or concurrent schedule design.

The primary advantage of this design is that interventions can be compared without baseline. The disadvantages of this design are that, 1) in order for one intervention to emerge as most effective, behavior must show rapid changes in performance, 2) limitations could be related to the number of interventions, and 3) multiple treatments could interfere, increasing the possibility that the application of multiple interventions is a contributing factor to behavior change (Kazdin, 2011; Yin, 2013). Secondary research designs allow researchers to synthesize research designs.

Secondary Research Designs

The three primary types of secondary research designs are: narrative literature reviews, systematic literature reviews, and meta-analyses. The primary difference among these designs is related to the procedures taken to gather data and review all the literature available in an unbiased and comprehensive way so other researchers can make objective conclusions about a given area of study.

Narrative literature reviews. Narrative literature reviews are commonly used by investigators to summarize the literature related to a topic of interest. Researchers who perform a narrative literature review may limit searches to studies specific to their perspective and area of interest. Their search may not be exhaustive or include an objective analysis of the studies they review. This method can be biased because the search method and inclusion criteria may be ambiguous
and the findings difficult to replicate (Baumeister & Leary, 1997).

**Systematic literature reviews.** A systematic literature review is a more formal and objective search of the existing literature base. This type of review includes a descriptive and concise search strategy that allows other researchers to replicate the search with similar search results. In a systematic review, the investigator collects and examines multiple studies and uses predetermined methods to search and analyze results (White & Schmidt, 2005).

While both narrative literature reviews and systematic literature reviews provide background about the existing knowledge base, they are both reliant on the author’s interpretation of the literature (Cooper, Hedges, & Valentine, 2009). A quantitative systematic review or meta-analysis can address these issues by using statistical methods to combine the results of multiple studies.

**Meta-analysis.** Meta-analysis design, the method selected for the current study, includes a literature review. However, the literature search is different from the search that might be included in a narrative literature review or systematic literature review. While all of these research tools begin with a research question or area of interest which may include specific search criteria, a meta-analysis can be completed only when sufficient quantitative outcomes are available from the search. One limitation of this review is that meta-analytic techniques are still developing and vary among researchers (Glass, 1976; Lau, Ioannidis, & Schmid, 1997; Lipsey & Wilson, 2001).

**Identifying gaps in the literature base.** Some concern about selection bias exists with meta-analysis results because they are dependent on published studies; it is difficult to ensure inclusion of all studies that meet inclusion criteria. In spite of these challenges, a meta-analysis can offer researchers an opportunity to use effect size calculation to quantify an integration of
evidence from multiple SCD studies. The meta-analysis is a sound alternative to statistical significance testing for SCD (Lau et al., 1997; Lipsey & Wilson, 2001). Meta-analyses can be used to compare effect sizes over a large number of studies, are not dependent on large sample sizes, and can evaluate the direction and magnitude of the effect size across studies. Finally, the analysis of existing and/or non-existing relationships between/among variables of interest can help to identify gaps in the existing literature (Lipsey & Wilson, 2001).

**Addressing an Identified Need.** The current study addresses an identified need (identification and assessment of interventions for secondary students with HFA in the regular education setting). This study is a meta-analysis of studies on effective strategies and/or interventions for adolescent students with HFA in regular education settings. This research contributes to the existing literature by addressing discrepancies among previously reported results and addressing the gaps in the literature base by offering a summary of research findings and representing those findings in a sophisticated manner.

To ensure that this analysis contributes to the professional literature, an extensive literature search was conducted for existing narrative literature reviews, systematic literature reviews, and meta-analyses (see Table 2). The search yielded six literature reviews and ten meta-analyses focused on analyzing the effectiveness of interventions for students with ASD.

**Studies related to social behavior and core academic content.** The primary intervention focus for 14 of the 15 studies was related to social behavior. Four studies analyzed interventions designed to help students with ASD develop specific academic content skills.

**Studies related to curriculum assistance.** Five studies analyzed interventions designed to help students with ASD develop skills commonly associated with curriculum assistance. All of the studies reported on student performance in special education settings, and five studies
reported interventions used in special education settings in public schools.

**Studies related to regular education settings.** Only three of the studies reviewed clearly identified interventions that could be applied in regular education settings. While the majority of the reviews addressed the needs of all students with ASD, none of reviews were specific to the needs of students with HFA in regular education settings, and only three studies focused on the needs of students with HFA (Campbell, 2003; de Bruin et al., 2013; Whalon, Conroy, Martinez, & Werch, 2015).

**Studies related to public school interventions.** Two meta-analyses somewhat resemble this current study. De Bruin et al (2013) reviewed SCD studies related to public school interventions for students with ASD. However, this review varied from DeBruin’s study in two ways. The students in the study were not identified as HFA, and they were not necessarily served in regular education settings. The second most similar review was Ma (2009); in this meta-analysis, interventions focused on the behavior of students with ASD were analyzed. Additionally, this review varied from the current study in two ways. The participants in these meta-analyses were both high and low functioning students from ages 4-22 with the majority of the students in the elementary setting. Participants were not necessarily served in the regular education setting.

**How this study contributes to the profession.** The results of this meta-analysis contributes to the existing knowledge base. Findings can be used with empirical research and produce quantitative results which examine relationships among variables of interest across studies that may not be discerned using other approaches. The results of this meta-analysis can help researchers realistically interpret studies by protecting against over-interpreting differences. Finally, this meta-analysis enhances the credibility of SCD by providing a reliable analysis of the
literature that can be reproduced and defended by other practitioners (Lipsey & Wilson, 2001).

**SCD Research Credibility**

**Subjective standards.** The increase in the variety of available statistical analysis methods for evaluating effect size can benefit researchers and help them make an appropriate choice depending on the research design and data characteristics. Unfortunately, the lack of regularly accepted, standardized research criteria for SCD studies contributes to misconceptions about results. SCD studies are not consistently recognized as true experiments because subjective standards contribute to bias and questionable reliability of data such as the selection of participants (Kazdin, 2011).

**Efforts to improve the standards.** The credibility of SCD research is based on evaluation of the quality of the study’s research design as well as the effect size (ES) of the reported results. This is an important distinction because a study might have a sound research design, but the data do not indicate a meaningful ES. On the other hand, a study may have a high ES, but the specific design may be weak and invalid. The Institute of Educational Sciences’ (IES) *What Works Clearinghouse* (WWC) has taken steps to assess studies that use single-case designs, and IES sets standards for the design validity. Unfortunately, these standards may exclude studies of interventions that might be effective for students with HFA in regular education settings because they do not meet IES standards.

**WWC standards.** In order for SCDs to meet IES standards, trained WWC reviewers evaluate the methodological soundness of the study, and determine whether the study meets standards, meets standards with reservations, or does not meet standards. Reviewers assess the study’s outcomes and categorize the evidence as demonstrating strong evidence, moderate evidence, or no evidence (Kratchwell et al., 2013). These rigorous standards evaluate the validity
of intervention effects in SCD studies when replicated across studies using the 5-3-20 threshold. This threshold can be met when at least five SCD studies are reviewed and meet standards (with or without reservations), the intervention must be studied by a minimum of three independent research teams, and includes a combined number of at least 20 participants (Horner & Spaulding, 2010; Kratchwell et al., 2013). The What Works Clearinghouse (WWC) helps to address the concern with design validity, but it does not assist with analysis of SCD study results.

**Analysis of SCD Results**

While SCD offers many advantages to practitioners, researchers must address the disadvantages. The most obvious disadvantage is the lack of consistent agreement about how to analyze whether or not a study demonstrates the true effect of the intervention by showing changes over intervention phases. SCD study effectiveness must be systematically tested to ensure conclusions are objective and accurate to determine if the results are clinically significant (positive results specific to that subject/setting) or statistically significant (other than random chance) – (Engel & Schutt, 2012; Kazdin, 2011). Graphing data points and visually inspecting the data trends displayed in the graphs is the traditional method of interpretation that can help researchers screen intervention studies with a positive effect.

**Visual analysis.** Visual analysis of data points represented in a line graph can be analyzed to evaluate the trend, level, and constancy of data between and within phases. This visual analysis method is commonly used in SCD because the intervention (independent variable) is designed to reduce inappropriate behavior or increase appropriate behavior and can be graphed in all phases of the study, and the participants of the study serve as their own control. This helps researchers assess change and evaluate intervention effectiveness (Gast & Hammond, 2010).

Unfortunately, visual analysis alone can be subjective and offer limited interpretation of
findings primarily because it is not as reliable if a study’s effect is not obvious. These interpretations are questionable because no agreed upon standards exist for making decisions about patterns and trends. Effect size measures and visual analysis of trends can allow more objective (reliable and reproducible) conclusions about the data (Kazdin, 2011; Lenz, 2012 and Parker & Hagan-Burke, 2007).

**Effect size.** Effect size (ES) measurements are used in meta-analysis research to summarize the statistical measurement of the power of the intervention or the strength of the correlation between variables. The American Psychological Association recommends that effect sizes in both SCD and group comparisons be reported to support the interpretations of research findings (2010). The increase in the number of SCD studies over in the past 15 years has resulted in the development of a variety of analysis methods available to researchers. Meta-analysis can combine multiple effect sizes of studies and compare findings.

**Comparisons among findings.** The fact that investigators use diverse standards for judging research rigor makes comparisons between findings difficult. Secondary research designs allow investigators to review and/or synthesize existing studies and make assumptions by combining evidence from similar studies. Many variations exist in how ES of SCD can be calculated and interpreted using both parametric and nonparametric statistics as discussed below.

**Parametric and nonparametric statistics.** Utilizing parametric statistics can be a challenge with SCD because the underlying assumptions of parametric testing may be difficult to demonstrate with smaller subject groups and fewer data points (Kazdin, 2011; Lenz, 2012). Various forms of ES have become widely accepted in group comparison and other group research study results. Non-overlap research methods, described below, consider all the data values, and they do not completely rely on means, medians, and modes.
Non-overlap Methods

Non-overlap research methods assess ES by observing the data points and considering the number of non-overlap data points between pre (baseline, Phase A) and post (treatment, Phase B) intervention phases. In other words, when determining effect size, it is important to ensure the data across phases do not overlap. These methods can offer researchers a way to synthesize data, and they do not require extensive training or statistical analysis. They are easy to calculate, and they are not restricted by distribution (Lenz, 2012; Parker, Vannest, & Davis, 2011). The most commonly used non-overlap techniques include: ELC (split middle line), PND (percentage of non-overlapping data), PAND (percentage of all non-overlapping data), Phi (robust Pearson’s phi), PEM (percentage of data points exceeding the median), IRD (improvement rate difference), NAP (non-overlap of all pairs), and Tau_{novlap} (Kendall’s tau nonoverlap) – (Parker, Vannest, & Davis, 2011).

**ELC (split middle line).** The ELC or split middle line considers the portion of data points in Phase B that is above the median slope of Phase A data points. It is calculated by identifying the Phase B data points that are above the median slope of Phase A data. The advantage of this method is that it takes into account the trend of the data in Phase A. In other words, this method removes the effect of time. The disadvantage of this method is that it is harder to distinguish between minimally effective treatments and very effective treatments (Parker et al., 2011; White & Haring, 1980).

**PND.** The Percent of Non-overlapping Data (PND) method is calculated by identifying the highest (or lowest if the intervention was designed to reduce a behavior) Phase A data point and determining the number of Phase B data points above the highest (or lowest) phase A data point over the total number of all data points in Phase B. The advantage of this method is that it
is easy to compute, and it has been widely used. The disadvantage of this method is that since researchers do not know its distribution, they use inference testing, and one outlying data point on the Phase A side can make an effective treatment appear to be ineffective since that one outlier can dictate results (Kratochwill, Hitchcock, Horner, Levin, Odom, Rindskopf, & Shadish, 2013; Parker & Vannest, 2009; Parker et al., 2011).

**PEM.** The percentage of data points exceeding the mean (PEM) method is calculated by extending a horizontal line from the median value of Phase A over into Phase B and determining the percentage of points in Phase B that exceed that line. The advantages of this method are that outliers do not overly affect the data, and it is very easy to compute. Inference testing can also be used with this method. The disadvantages of this method are that the median has to be a good representative of the data, and any trend that may be represented in Phase A is ignored (Parker, Hagan-Burke, & Vannest, 2007; Parker et al., 2011).

**IRD.** The improvement rate difference method (IRD) method is calculated by determining the minimum number of points required to be subtracted in order to remove all non-overlapping points. The ratio of remaining points in Phase A divided by the total points in Phase A is subtracted from the ratio of the remaining points in Phase B divided by the total points in Phase B. In a robust IRD, the removed points are assigned half to Phase A and half to Phase B regardless of how the removal was determined and the procedure was followed. The advantages of this method are that the robust IRD and the robust Phi are the same statistic -- this statistic more widely accepted in the research community. The disadvantages of this method are that this method does not account for trends and would not be as successful at the high ends of effectiveness (Parker et al., 2011; Parker & Vannest, 2009).

**NAP.** The non-overlap of all pairs method is calculated by finding the number of pairs
which show improvement from phase A to Phase B and then adding to that 0.5 of the pairs that are exactly equal from phase A to Phase B and dividing by the total number of pairs. The advantage of this method is that the entire data set is considered; no points are ignored. The disadvantage of this method is that it is more difficult to compute than the other visual methods (Parker et al., 2009; Parker, et al., 2011).

\textbf{\textit{\textit{Tau}}}_\text{nonoverlap}. Kendall’s tau nonoverlap method is calculated by taking the number of pairs which show improvement from Phase A to Phase B, subtracting out pairs that show decline from Phase A to Phase B, and dividing by the total number of pairs. The advantage of this method is that most of the data points from both phases are considered (ties do not count). The disadvantages of this method are that this is harder to compute by hand, and the extreme points in Phase A will have a larger effect on this index than on NAP (Parker et al., 2011).

\textbf{PAND}. The percentage of all non-overlapping data (PAND), the method used for this study, is calculated by removing the minimum number of data points (from either side or both) that eliminate all non-overlapping among the data points. The number of points that remain (the overlapping data points) is divided by the total number of points, resulting in a percentage. The closer to 100 that percentage is, the more effective a treatment is. The advantage of this method is that this method is easy to use and researchers can distinguish between minimally effective treatments and very effective treatments. Finally, this method can be paired with Phi to determine a confidence interval for the quantity being measured. The disadvantage of this method is that it does not take a trend into account and thus a treatment’s effectiveness can be overestimated or an ineffective treatment can be thought to be effective (Parker et al., 2007; Parker et al., 2011).

\textbf{Phi (robust Pearson’s phi)}. Phi is a test that is run concurrently with PAND. It is
calculated by making a two-by two table where the ratio of half the removed points from Phase A is divided by the remaining points in Phase A. This is compared to the ratio of remaining points from Phase B divided by the removed points from Phase B. The advantage of this method is that it can be paired with PAND to make it more powerful. The disadvantages of this method are that it is not as easy to compute, and outliers can still have a large impact on the data (Burns, Codding, Boice, & Lukito, 2010; Parker et al., 2007; Parker et al., 2011; Schneider, Goldstein, & Parker, 2008).

**Rationale for Selected Method**

This meta-analysis research study considers only those published studies with designs that possess some minimum level of validity using standards from WWC. Then on each of those included studies, ES was calculated, using PAND and RPhi as ES statistics. This method was selected because it is the best compromise to determine the effectiveness of the interventions under study. Results are quantified, and through the use of inference, more confident conclusions can be made in regards to the efficacy of treatment because this method uses all data points and outliers do not carry as much weight as with the PND method. Additionally, PAND can be translated into Pearson’s Phi, which allows for calculations of p values and confidence intervals. These combined methods can discriminate among lower and higher study effects (Parker, Vannest, & Davis, 2011) to help determine the credibility of study findings. In the current study, this analysis uses non parametric methods due to the fact that the studies being analyzed have too small sample sizes to use parametric methods.

The current study uses non-parametric statistics (described above) because parametric methods require sample sizes of at least 30 for the methods of parametric analysis to be effective. The sample sizes of the studies included in this analysis were in many cases one or two
participants. Non parametric analysis is designed to be used on single case studies which is what many of these studies were. Non parametric analysis differs from parametric analysis in the following ways. Non parametric analysis is less dependent upon sample size. Sample size does affect PAND and RPhi in that a larger total number of points means that it takes more overlapping points to change the percentage but is irrelevant to the size of the confidence interval for RPhi. The size of the confidence interval is affected by the closeness of size between the baseline and treatment phases. The closer in size those phases are, the smaller the interval. Also, non-parametric analysis uses the left skewed chi squared distribution instead of the symmetrical normal distribution which leads to left skewed confidence intervals instead of centered confidence intervals.

**Overview of this Research Study**

**Study purpose**

The purpose of this meta-analysis is to identify effective research-based interventions and/or teaching strategies to assist adolescent students with HFA in regular education settings. After systematically searching the literature, results are analyzed using PAND/RPhi to determine effect sizes of studies included in the meta-analysis and report findings related to the efficacy of varied categories of interventions, and discuss relationships among variables of interest that might help educators make informed decisions related to appropriate service delivery and/or potential staff development/teacher education needs.

While this analysis is similar in some ways to other reviews discussed previously, it is also unique. This search includes a greater number of databases as well as a larger number of journals that were hand searched for studies that meet inclusion criteria. The included studies are exclusively related to interventions for adolescent students with HFA in public school settings.
(middle and high school) served in regular education classes. The date range of my analysis includes SCD studies from 1985-2015. The additional inclusion criteria for this study are as follows: participants at least 11 years old, written in English, and findings represented in a graph sufficient to generate PAND and RPhi coefficients.

The included studies represent varied types of research design methodology (withdrawal, multiple baseline and multiple treatments) as well as interventions designed to address both academic and behavior. IES standards were used to evaluate study quality. Key word descriptors are more specific to capture more potential articles.

**Research Questions**

Considering the studies that meet my inclusion and exclusion criteria:

1. How effective are the interventions for learning for students with HFA in the regular education setting?
   a. How effective are the interventions for academic content knowledge learning (interventions designed to improve student skills and/or promote success in a specific content area) for students with HFA in the regular education setting?
   b. How effective are the interventions for curriculum assistance learning (interventions designed to develop or enhance the participant’s skills with organization; study skills, test taking, and/or problem solving) for students with HFA in the regular education setting?
2. How effective are the interventions for appropriate behavior for students with HFA in the regular education setting?
3. How does effectiveness of interventions vary by study characteristics, interventions, and other variables?
Chapter Summary

This is an important area of research because of the lack of information related to how to meet the needs of students with HFA in regular education settings, along with the increase of students being identified with this disorder and the shortage of professionals in the field who are prepared to meet their needs as these students spend more time in regular classrooms. The quality of the research studies noted in the literature base, as well as the lack of information related to meaningful effect of study findings, is an additional source of concern. A review of existing research was conducted in this area using a meta-analysis format. In chapter three the research design and methodology used in this study are described. Results are presented in chapter four; in Chapter five, findings are discussed in more detail as well as the implications of the findings on future research needs.
Chapter 3: METHOD

In this chapter, methodology is described to address the research questions noted in the previous chapter: (a) How effective are the interventions for learning (academic and curriculum assistance skills) for students with HFA in the regular?, (b) How effective are the interventions for appropriate behavior for students with HFA in the regular education setting?, and (c) How does effectiveness of interventions vary by study characteristics, interventions, and other coded variables (e.g., gender, race, intellectual ability, etc.)?

The research questions were investigated as follows. First, published studies were located relevant to the research questions. Next, selection criteria were applied to the located published studies to identify appropriately qualifying studies. Then each study included was analyzed and coded.

Locating Studies

An extensive literature search was conducted to locate studies published over the past 30 years that used single case study (SCD) research to evaluate interventions for adolescent students with high functioning autism (HFA). To qualify, a study must have a publication date of 1985 through 2015. This date selection is in line with defined (DSM) changes in how ASD was diagnosed as well as the introduction of studies relating to how to help students with ASD achieve success in inclusion settings. Search moderators were used in conjunction with current and previous diagnosed conditions associated with autism within the given date range. In order for a study to be included, the study must have been in-print or online, including those appearing online ahead of eventual in-print. It must have examined the effect of an educational or psychological intervention upon students with ASD in a regular education (non-special education) classroom in a public school in the secondary (middle or high school). The study must
have used a SCD procedure, not a group comparison design, to examine the effects.

**Electronic literature search.** The following databases were searched: ERIC, Academic Search Complete, MEDLINE, Web of Science, Google Scholar, PsychARTICLES and PsychINFO. Boolean search terms were used with specific key words and operators. Boolean Operators such as AND, OR, NOT or AND NOT were used to combine or exclude keywords in the search; using these operators produced a focused and productive search of large databases. When appropriate, the word AND was used to require both terms (on either side of the word AND) to be in each search item returned. If one term was contained in the document and the other was not, the item was not included in the search results. OR was another Boolean indicator used to narrow the search. When OR was used, either term (or both) terms was included in the search. The word NOT was used to search the records; any records containing the term after the operator NOT would not be subtracted from the search results. The asterisk was used on to indicate the root word/stem of the word preceding the asterisk; in this case, any word that began with the root/stem of the word by the asterisk was included in the search results. Parentheses were used to summarize OR statements for the search engines to execute them properly (Eastman, & Jansen, 2003).

The search operators and keywords used in this study were as follows: (teach* method* or strateg* or behav* mod* or intervent*) AND (autism or autis* or ASD or HFA or high funct* autis* or asperg* or PDD or pervasive development* disorder* or social* communication* disorder*) AND (adolescen* or middle school* or high school*) NOT (intellectual disorder* or mental* retard*) NOT (elementary school* or elementary) NOT (meta-analys* or literature review* or systematic review) NOT (medic* or medicine).

**Selected journal search.** In addition, a search of five journals associated with meeting
the needs of students with ASD and/or HFA was completed. This included an electronic search of articles published between the years 2001-2015 in the following journals: *Autism – the International Journal of Research and Practice; Autism Research and Treatment; Focus on Autism and Other Developmental Disabilities; Journal of Autism and Developmental Disorders;* and *Research in Autism Spectrum Disorders.*

**Reference list search.** After the selected journal search, the reference lists were examined for literature reviews, systematic literature reviews, and meta-analyses related to effective interventions for students with HFA in school settings: de Bruin et al., 2013 and Ma, 2009. After the third stage screen (described below), an additional examination was completed of the reference lists of all articles qualifying to remain in the tentative collection (i.e., those not excluded via the screening criteria).

**Inclusion and Exclusion Criteria**

The criteria for study selection was applied sequentially to the journal articles located through the study location procedures. As each criterion was applied to studies located through the electronic and other literature search, several studies were eliminated from consideration because they did not meet the inclusion criteria. The inclusion criteria were as follows: diagnosed with ASD (or other terms associated with ASD), minimum age of 11 years, enrollment in at least one regular education class, intervention in the public school setting, average range of intelligence, SCD research study, line graph of results meeting criteria for PAND analysis, and published in a peer reviewed journal within the given date range. The criteria that tend to be more easily applied (e.g., by viewing an article’s citation or abstract) were applied earlier in the selection process, while those that were more time-consuming (reading a study’s Method section) or difficult to use were applied later in the process. When uncertain
whether the criterion applies, the study was retained for further examination.

After the last inclusion criterion was applied, the studies that were not eliminated constituted the tentative collection of studies for this meta-analysis. The collection was tentative at that point because it was possible that as studies were more thoroughly examined when coded, it was determined that the study does not meet one of the criteria, even though it had not been eliminated in the initial application of the criteria. The inclusion and exclusion criteria were applied in two screening stages.

**First Screening.** In the first screening phase, the entire electronic search list was sorted alphabetically by author and uploaded to RefWorks where it was later downloaded to an excel worksheet. The resulting worksheet was then alphabetized by author and abstracts of each citation were scanned for the following information.

**Phase 1. (a) Publication date:** In this step, it was confirmed that the article was published in the years 1985-2015 as identified in the study location procedures. Articles were excluded that did not meet the date criterion.

(b) **Language:** The article must have been published in English (regardless of what language the participants used or where it was conducted), as called for in the study location procedures. Articles that did not meet the English language criterion were excluded.

(c) **Study:** The article had to contain one or more original studies, each of which presents numerical results of measurement of the behavior of a human. Articles that did not have at least one such study were excluded. Studies focused on medical interventions or treatments and feature articles designed for parents, medical professionals or non-educational service providers (physical therapists, social workers, etc.) that did not relate to an original study were also excluded. Secondary research studies (narrative literature reviews, systematic literature reviews
and meta-analyses) were not included.

(d) **Student age:** Given that the focus of this analysis was secondary students in middle and high school settings, the age of at least one study participant must be within the age range (11-22). Studies that did not involve at least one participant in the specified age range were excluded. If in a study at least one participant was in the qualifying age range, the study was included but consideration was given only to data for the qualifying participant(s). When specific participant ages were not cited by the authors, but the student was identified as being in middle or high school or in grades 6-12, the student was included. For the purposes of this search, students were assumed to have entered first grade at age five/six and started middle school by age ten/eleven (depending on when the student’s birthday. Students in 6th grade were categorized as ages (10-11); 7th grade were categorized as ages (12), and 8th grade were categorized as ages (13). Students in ninth grade were categorized as (14), tenth grade (15), eleventh grade (16) and twelfth grade (17-22). The cut off age of 22 was selected because students with special needs can be served in public school settings until their 21st birthday (which could mean they are in school when they turn 22).

(e) **Autism:** At least one participant in the study was described as having autism, ASD, Asperger’s disorder, Pervasive Developmental Disorder PDD or PDD – Not Otherwise Stated (PDD-NOS), Social Communication Disorder was confirmed. These search terms reflect references to disorders associated with ASD in DSM 3, DSM 4, and DSM 5. If not, the article was excluded. If ASD was mentioned in the abstract, and specific indicators of HFA were not obvious in the abstract, the study was retained for further examination.

**Phase 2.** Articles whose citation abstracts did not have sufficient information with which to exclude and/or the abstract indicated the article should be included in the analysis were
examined more closely. In this phase, the articles were electronically downloaded and to verify the presence of a line or column graph depicting data across multiple recording sessions, as is the rule in SCD experiments that would enable PAND effect size calculation. If present, the study’s method section was closely reviewed to determine if the study should be retained for further screening.

**Second screening.** In the second screening phase, the studies which were not excluded in the first screening phase were analyzed more thoroughly by reading the entire study to ensure it met all inclusion criteria.

(a) *High functioning autism:* In cases where the citation abstract did not clearly identify that at least one participant would meet the HFA standard for this study, the method section was analyzed to confirm at least one participant was described as high-functioning autism or like concept (e.g., Asperger’s disorder, autistic disorder, etc.)

(b) *Intellectual disability:* In cases where the citation abstract did not clearly indicate the participants meet the IQ range of the study, participant descriptors were examined in the method section to determine whether the participant under consideration met the intellectual ability requirements for this study. For the purposes of this analysis, an IQ score of at least 76 was used as the lowest score considered for inclusion as “high functioning.”

This determination was made in consideration of the scarcity of relevant studies and as well as the Childhood Autism Rating Scale (CARS) manual which uses a cutoff of 80 to distinguish between high and low functioning. Given that very few of the studies reported specific assessments used to determine intellectual ability, and the fact that all standardized assessments have a degree of error associated with them, the potential range of scores associated with an 80 IQ was used (at least 76).
Full scale IQ tests generally have at least a few points error. For example, for a child with a FSIQ score of 85, their true score might actually fall between 80 and 91 given measurement error (Schopler, Reichler, & Renner, 2002). Therefore, IQ ranges of 76-84 were included in the average range for this study. Students with IQ scores <76 are also less likely to be served in regular education settings. Students described as having average or above average intellectual abilities were included in this study because the focus is on HFA.

An additional reason for including students with IQ scores somewhat lower than average was to address the needs of students with autism participating in regular education classes. The purpose of this study is to identify all possible interventions and/or strategies that regular education teachers may use to meet the diverse needs of students with HFA enrolled in their classes.

(c) Regular education: In cases where the citation abstract did not clearly indicate service in the regular education setting, the article was reviewed in detail to confirm at least one qualifying participant was assigned to one or more regular education, regular education, mainstream or inclusion classroom in a public middle or high school setting. If not, the study was excluded.

While it is possible for students with below average abilities to be included in a non-content, regular education class such as physical education, art or music, these students were not excluded from consideration unless the researchers clearly identified them as being intellectual disabled or having significantly below average abilities. Although the needs of these students may vary from students in core content classes, the studies were not excluded.

It is the responsibility of the individualized education plan (IEP) team to make decisions about service delivery that are in the best interest of the student. The IEP ensures that all students
served in regular education settings have the ability to be successful given appropriate instruction by the regular education teacher. Therefore, studies that focus on the needs of these students are relevant and included in this analysis.

This decision was made in part because the author(s) of the selected studies may not have reported specific information about the type of regular education class. In addition, information about interventions and/or strategies for students in all regular education settings may be useful information for all educators charged with meeting their needs in inclusive setting. Specific regular education information was coded when available for further analysis.

(d) School intervention: In cases where the citation abstract did not clearly indicate that the intervention was implemented in a public school, the study was read in detail to confirm this requirement. Studies in which the intervention was drug therapy, surgery, or other interventions that are not educational or psychological were excluded as were those that happened outside a school setting or before/after the school day such as at home, before school, after school, during transitions, at lunch. Participants not clearly served in a public school setting which serves both students with disabilities and their nondisabled peers were not included (e.g., public alternative school, residential facility, hospital, and programs exclusively for students with disabilities).

Third screening. In the third screening phase, the entire study was reviewed again more closely to identify details and code required variables of interest to verify that the study met all the inclusion criteria (see Table 3).

Only SCD studies whose method clearly outlined manipulation of an independent variable and measurement of a dependent variable were considered for inclusion. ABAB reversal and/or withdrawal designs that assess intervention during each phase were included. Variations of this design such as (ABABAB) as well as alternating treatment designs (ABCBC) were
included. Variations of multiple baseline designs (across participants, settings, behaviors, time, etc.) that measured treatment effects by introducing intervention to different baselines at different points in time were considered (Kazdin, 2011).

Studies must have included at least three data points of graphed for each phase and repeated observations of subject performance over time in pre (baseline/phase A) and post (treatment/phase B) intervention phases. In the case of alternating treatment designs, all intervention data points were combined and compared to baseline data. Alternating treatment and withdrawal studies were analyzed by comparing each treatment phase with the baseline phase. Studies including varying interventions were assessed by comparing phase B to phase A (i.e., each treatment with the proceeding baseline).

Selected studies using multiple treatment interventions were assessed by combining all baseline phases and all intervention phases whether or not they have been effective. This may mean that Phases B and C were combined to compare with Phase A. Studies that implemented only baseline Phase A and intervention Phase B designs were excluded from consideration because these studies have not been studied adequately (even if for ethical purposes).

**Studies Included**

The search outlined in Chapter 3 resulted in the identification of 2,967 studies of which 23 met the inclusion criteria. The electronic search identified 2,885 studies. The journal search yielded six additional studies for consideration; the ancestry search led to 74 additional studies, and advice from experts resulted in an additional two studies being considered for inclusion. Of the 23 studies which met the inclusion criteria, 20 were captured in the original electronic search, one was found in the journal search, and two were identified in the ancestry search of the included studies.
**Studies excluded.** Of the 2,967 studies identified in the search, 2,944 studies were excluded for the following reasons (see Appendix B for the list of excluded studies).

1. The participants in the study did not meet the age and/or IQ requirements (n=246).
2. The participants in the study were not identified as having autism (n=807).
3. The study was not a qualifying single case design study (n=861).
4. The intervention was medical in nature (n=432).
5. The study was not written in English (n=204).
6. The participants in the study did not attend regular education classes (n=80).
7. The study did not include a line graph for each phase and repeated observations of subject performance over time (n=314).

The remaining 23 studies described by 21 research teams met the criteria, and they were included in this meta-analysis (see Table 5). Table 6 presents an overview of all included studies. Number of studies and number of comparisons are denoted, \( n = \) number of studies, and \( k = \) number of comparisons).

**Coding Studies**

**Study characteristics.** Table 3 represents codification of independent and dependent variables considered in this meta-analysis. Included studies were assigned a number and the author, publication year and journal were coded into an excel spreadsheet.

**Research design.** Numbers were assigned to each of the following research designs: withdrawal, multiple baseline across participants, multiple baseline across settings, multiple baseline across behaviors and multiple treatment designs.

**Study quality indicators.** The information related to the quality of quality of evidence presented in each study was recorded as follows: inter-observer agreement recorded on at least
20% of observations and met minimum threshold standards. Graphed data met WWC minimum standards for each research design type, and intervention fidelity, generalization and maintenance were considered and recorded by researchers.

**Intervention category.** The independent variables of included studies were identified and coded into the following intervention categories: Interventions designed to assist students with specific academic content in a core area (reading, writing, mathematics, science or social studies) were coded as “AC.” Those interventions implemented to teach students regular curriculum assistance skills (e.g., test taking strategies) which could be applied in multiple settings such as organization, time management were coded as “CA.” Interventions focused on enhancing student social and/or behavioral skills such as peer interactions (on task behavior, and/or appropriate problem solving or controlling emotions) were coded as “SB.” All studies which met the criteria in this screening were later considered for effect size measurement and included in the final meta-analysis.

**Desired intervention outcome.** The desired intervention outcomes for each study were coded to identify if the intervention was designed to increase or enhance social interaction skills, increase or enhance academic skills or decrease inappropriate behavior.

**Dependent variable consideration.** Dependent variables were coded by the following types: inappropriate behavior, academic social engagement, non-academic social engagement, on-task behaviors and academic content mastery.

**Independent setting.** The following intervention settings were coded: special education classrooms and/or resource room settings, regular education classrooms, cafeteria, hallway or other crowded area, and other area in the school during the school day.
**Intervention agent.** The following intervention agents were coded: school staff, non-school staff, combined staff and non-staff, and intervention agent not clearly stated.

**Intervention length.** The following intervention lengths were identified and coded: intervention sessions reported and data collected from 1-7 days; intervention sessions reported and data collected from 8-14 days; intervention sessions reported and data collected from 15-20 days, and intervention sessions reported and data collected for 20 or more days.

**Participant demographics.** Characteristics of individual participants were recorded and coded as follows: name, age, and grade level. In cases where age and where grade level were specifically noted in the article, it was coded as written. If only age was provided, those in 6th grade were assumed to be 12 years old, seventh grade 13 years old, etc. If only grade level was reported, age assumptions were applied in the same manner. Students between the ages of 11-14 and in grades 5-8 were coded middle school. Students between the ages of 14-17 in grades 9-12 were coded as high school. Gender and race were recorded as follows: gender (1= male, 2= female), race (1= white; 2= black; 3= Hispanic; 4= biracial; 5= not stated).

**Autism diagnosis.** The method of autism diagnosis was coded as follows: 1 = Diagnostic Statistical Manual – DSM diagnosis, 2 = school based diagnosis, 3 = private doctor/facility or other independent agency, and 4 = not stated how the participant was diagnosed with autism.

**Intellectual ability.** The intellectual ability of included participants was identified and recorded as follows: 1= grade level intellectual ability reported, 2 = average or typical intellectual ability reported, 3 = above average intellectual ability reported, 4 = Asperger Syndrome diagnosis, and 5 = not stated but participant attends regular education classes with description of grade level ability in text.
**Regular education services.** The regular education services of included participants were identified and coded as follows: 1 = student participates in inclusion/mainstream classes, 2 = not specifically stated, 3 = English language arts class in regular education, 4 = math class in regular education, 5 = social studies class in regular education, 6 = science class in regular education; 7 = elective class in regular education, and 8 = most or all of the day in regular education classes.

The number of regular education classes were recorded when noted by researchers.

**Special education services.** The special education services of included participants were identified and coded as follows: 1 = resource room, 2 = curriculum assistance or study skills, 3 = English language arts in special education, 4 = math in special education, 5 = science in special education, 6 = social studies in special education, 7 = other (unclear services), 8 = student served in special education part of the day, 9 = student participates in special education most of the day, and 10 = social skills support in special education. The assistance of a paraprofessional as well as the number of special education was identified and coded when reported.

**Curriculum Content.** Specific data related to regular education curriculum class were coded as follows content area classes (English Language Arts/literacy, mathematics, science, or social studies), other or not stated (NS) when the name of the class is unclear or not stated.

**Participant Characteristics.** Table 10 presents an overview of the demographic information coded for 39 participants in the included studies which resulted in 78 (k) comparisons. The following describes participants included in this analysis.

**Sex.** Of the participants for whom sex was reported, 35 were males (k=68) and 4 were females (k=10).
Race. Although most of the studies did not report participant race (n=25; k=39), when race was reported, the demographics of participants was as follows: Caucasian (n=8; k=21), African American (n=3; k=6), Hispanic (n=2; k=8), and biracial (n=1; k=4).

Age. Although most of the participants were younger, the age range was 11-18 with the following breakdown: eleven (n=4), twelve (n=5), thirteen (n=13), fourteen (n=4), fifteen (n=2), sixteen (n=5), seventeen (n=5), and eighteen (n=1). The 78 comparisons were analyzed for students within the following categories: ages 11-12 (k=18), ages 13-14 (k=34), ages 15-16 (k=15), and ages 17-18 (k=11).

Grade. Of the 39 participants, most of them were in middle school (64%) settings, but a few of the studies focused on the needs of students in high schools (36%). Specific grades were as follows: sixth (n=8), seventh (n=9), eighth (n=8), ninth (n=2), tenth (n=3), eleventh (n=5), and twelfth (n=4). The 78 comparisons were analyzed for students within the following categories: grade 6 (k=14), grades 7-8 (k=34), grades 9-10 (k=5), and grades 11-12 (k=14).

Intellectual ability. The cognitive abilities of participants was reported for more than half (n=20) of the study participants. Specific IQ scores were reported as follows: There were 12 comparisons for students with IQ scores between scores of 78-89; their breakdown is as follows: 78 (n=1), 83 (k=1), 84 (n=2), 85 (n=1), and 88 (n=1). Nine comparisons were analyzed for students with IQ scores 90-100; their breakdown was as follows: 90 (n=1), 94 (n=1), 95 (n=2), 98 (n=1), and 99 (n=1). Eleven comparisons were analyzed for students with IQ scores 100-110; their breakdown was as follows: 101 (n=3), 102 (n=1), 105 (n=1), 106 (n=1), 107(n=1), and 110 (n=1).

Specific IQ scores were not reported for 19 participants, but 14 students met the intellectual ability standard for this analysis because they were described as participating in
regular education and having at least average intellectual abilities. Twenty four comparisons were analyzed by participants described as having average or typical intelligence (n=5) or grade level abilities (n=1). Nine comparisons were analyzed for students identified as having a diagnosis of Asperger syndrome (n=6), above average intelligence (n=1), or verbal/mental intelligence two years higher than age expectations (n=1).

The remaining five participants met inclusion criteria based on their participation in regular education classrooms (k=13); two students were fully included, and three students were mainstreamed part of the day in regular education courses. Tables 9 and 13 represent characteristics of study participants related to reported intellectual ability.

**Diagnosis method.** Table 11 represents an overview of the autism diagnosis method of participants included in this meta-analysis. While all students in the study were identified as having autism, the method of diagnosis varied. Many of the studies (61%) did not report a participant diagnosis method (n=14; k=3). Fourteen participants were identified using DSM criteria (k=28). Other methods of diagnosis include school based evaluations (n=4; k=7). Eleven comparisons were analyzed for participants diagnosed by private evaluations and/or other unspecified independent evaluations (n=8).

**Special education participation.** Tables 12 and 13 present details about special education service delivery reported in the included studies. Information related to specific service delivery in special education settings for the 39 participants was reported in different ways. All students were reported to have been served by special education, but most studies (n=27; k=37) did not provide specific details about the frequency of special education support. The remaining 12 participants were served as follows: one special education class daily (n=8;
k=30), two special education classes daily (n=1; k=9), three or four special education classes daily (n=2; k=2), and served mostly in special education (n=1; k=2).

Participation in specific special education classes was reported as follows: seven students were served in special education core content area classes such as English (n=4; k=11), math (n=1; k=4), science (n=1; k=1), and social studies (n=1; k=2). Other special education classes reported were curriculum assistance (n=1; k=7), social skills (n=7; k=3), and resource (n=4; k=19). Four students were assisted by a paraprofessional for at least part of the day which resulted in 16 comparisons. This was because treatment data was collected on different behaviors for the same for students. For example, if the student was interacting with peers in the cafeteria, data collection was collected regarding how often the student initiated conversation, responded to a peer comment, and continued a discussion with a peer and overall interactions such as using hand gestures or making eye contact while interacting with peers.

Regular education participation. Tables 13 and 14 present details about regular education service delivery reported in the included studies. Information related to specific service delivery in regular education settings for the 39 participants was reported in different ways. The percent of time students were served in regular education settings was reported for 9 (k=33) participants using the following percentages: 70% (n=1), 76% (n=2), 80% (n=2), and 100% (n=4).

The number of regular education classes was reported for 21 students (54%), and the descriptive categories were as follows: two classes (n=8; k=7), most of the day (n=6; k=41), one class (n=2; k=2), three classes (n=2; k=3), four classes (n=1; k=1), and five classes (n=1; k=1). The remaining 10 (k=23) students were reported to have attended regular education classes, but the specific number or percentage of time students spent in general education was not stated.
Participation in specific regular education academic content classes was as follows: math (n=10; k=5), science (n=9; k=6), English Language Arts (n=8; k=9), social studies (n=7; k=7), electives (n=5; k=3), and lunch (n=5; k=21).

Reliability

To strengthen the results of both the screening tools and effect size measurements as well as to address the possibility of researcher bias and ensure screening tools and coding of information was consistently gathered in a reliable manner, reliability checks by other evaluators (a doctoral student and a regular education teacher) were integrated into this research project on a regular basis. Studies progressing onto phase three were verified by the two other observers trained in screening and coding selected studies (Kazdin, 2011).

Of the 23 included studies, approximately 40% (11) were randomly selected for inter-observer and inter-coder agreement, and approximately 80% (20) of a random selection of excluded studies were reviewed to verify inclusion and exclusion criteria (de Bruin et. al, 2013; Kazdin, 2011). PAND overlap calculations were considered in reliability checks. At least fifty percent of the PAND/RPhi scores were reviewed for reliability. Agreement was calculated by dividing the number of agreements by the sum of the number of agreements and disagreements, and then multiplying the quotient by 100 (Kazdin, 2011).

Interobserver Agreement (IOA) on Coding

Inter-observer agreement (IOA) data were collected by a doctoral student and a volunteer regular education teacher to evaluate whether studies met or did not meet inclusion criteria on 40% of a random selection of studies included (n=10) and twice the same number of studies that were excluded (n=20) using the formula ([number of agreements/the sum of the number of agreements + number of disagreements] x 100).
agreements plus disagreements] * 100). Reliability was 100% on both inclusion and exclusion (deBruin, 2013).

IOA agreement data were collected for each variable coded on 20% (n=5) of the 24 included studies using the formula ([number of agreements/the sum of the number of agreements plus disagreements] * 100). Overall the inter-coder agreement ranged from 97% to 100%. The range for inter-coder agreement (ICA) for study related variables was (publication years = 100%, journal title = 100%, research design = 100%, qualifying participant = 97%, participant sex = 100%, participant race = 100%, participant age = 100%, participant grade = 100%, autism diagnosis method = 100%, intellectual ability = 100%, special education participation = 97%, and regular education participation = 91%.

Data Analysis

Data analysis was conducted in three ways. An excel spreadsheet was used to calculate PAND, RPhi and confidence intervals for specific data in phase comparisons and conduct overall study analysis in each included study. Overall PAND, overall RPhi and confidence intervals were calculated to analyze the disaggregated data related to variables of interest as whether an intervention type appeared to be effective.

Effect Sizes. Graphed data from studies included in this meta-analysis were analyzed to determine effect size using PAND/RPhi. The PAND/RPhi procedure was utilized to answer questions about intervention effectiveness/effect sizes in SCD studies. These results were used to systematically synthesize outcomes for single case design studies. Confidence intervals and p values for RPhi were generated and evaluated (Parker et al., 2007; Mastropieri & Scruggs, 1985).

Comparison rules. The following rules were used to analyze the data: Studies with one treatment (no matter how often it was withdrawn and repeated) were treated as if it were a
control vs. treatment. This was accomplished by combining all points in all control phases together to make one control phase and combining all points across treatment phases into one treatment phase. This yielded a single comparison of treatment to non-treatment. For studies with more than one treatment, each treatment was compared to the baseline which preceded it. This practice yielded one comparison (k) per treatment.

For studies using alternating and/or simultaneous treatments, each treatment resulted in one comparison (without regard to if the treatments are the same or different). In studies using a method of withdrawal and alternating treatment, the treatment phases were compared with the previous baselines as in the studies with more than one treatment. If studies have multiple baselines, each baseline was compared to its subsequent treatment or treatments.

Each study was compared using PAND and RPhi and the studies overall were compared using an overall PAND and RPhi all of which are described below. To get the PAND score for an individual study, the minimum number of points to eliminate all overlap were removed to make the following fraction: (points remaining after removal)/ (total number of points in all phases). For example, if a study had 12 baseline and 8 treatment points before overlapping points are removed, 2 points were removed to get a PAND of (12 + 8 − 2) /(12 + 8) which was 18/20 or 0.90.

Robust Phi. (RPhi) was calculated by defining 4 variables a, b, c, and d. B and c were defined as the percent of the total data points removed divided by the number of phases in the study. To find “a” and “d,” spread sheet column was used to record the percent of points in all the base phases of the study and a column for percent of points in the treatment phases of the study. The variable “a” was defined as the difference between the percent of points which were in the treatment Phases and “d” was defined as the difference between those in the base phase of the
study and b. A confidence interval were obtained using an online two way contingency table calculator (http://statpages.info/ctab2x2.html).

To get RPhi, this table was created into a spread sheet.

<table>
<thead>
<tr>
<th>a</th>
<th>b</th>
<th>a + b</th>
</tr>
</thead>
<tbody>
<tr>
<td>c</td>
<td>d</td>
<td>c + d</td>
</tr>
<tr>
<td>a+c</td>
<td>b+d</td>
<td>a + b + c + d</td>
</tr>
</tbody>
</table>

RPhi is \((a/(a+c)) - (b/(b+d))\)

**Example.** In the case that an included study has 15 data points total in two baseline phases, and 18 data points in two treatment phases, with 6 data points overlapping

The RPhi formula is calculated as follows: \(a = (12-1)/12 = 91.7\%\) \(b = c = 1/20 = 05\%\) \(d = (8-1)/8 = 87.5\%\); so that is \(91.7/96.7 - 5/92.5 = 0.894\)

**PAND & RPhi calculated per study.** Articles with multiple qualifying studies had multiple effect sizes. This statistic was calculated by the percentage of intervention data points that did not overlap with the highest baseline data point; the percentage of data left over after eliminating the fewest data points that excluded all overlap. PAND was scaled from 50 to 100, where 50\% is chance level. PAND was intended to offer nonoverlap with an effect size (Phi) the correlation coefficient. PAND helped show if a treatment is effective but since it treats any size of effect the same, RPhi was used to measure effect size.

The first step to calculate PAND was to visually inspect the graphs of the selected studies and determine if the intervention was designed to increase or decrease behavior. This was an important step in order to verify assessment of data points that are above or below the line. If a study was designed to decrease behaviors, the points would be below; if it was designed to
increase good behaviors, the points would be above the line.

The next step was to use a transparent ruler to draw a horizontal line through both phase A and phase B. The line should have the least number of total overlapping points which was determined by counting overlapping points on both sides of the line. If the intervention were designed to increase appropriate behavior, the line was drawn to minimize the total number of points in phase A that were beneath the line or above the line in phase B. If the intervention were designed to decrease inappropriate behavior, the line was drawn to minimize the total number of points that were above the line in phase A or below the line in phase B.

PAND was calculated by counting the total number of points in all phases and identifying how many points must be removed to eliminate all overlap. If the intervention were designed to decrease inappropriate behavior, all the points below the line in phase A or above the line in phase B were considered. If the intervention were designed to increase appropriate behavior, the points in phase A that are above the line or the points that are below the line in phase B were removed.

The next step was to use the excel spreadsheet to calculate PAND and RPhi. The spreadsheet included one column for each phase to input the total number of points in each phase. Each baseline/treatment phase had a column; therefore, in an ABA study, there were two columns. In an ABAB design, there were three columns to compare A1:B1; B1:A2; A2: B2. The number or points that had to be removed in each phase was put into these columns.

The next two columns in the spreadsheet contained the total number of data points in all phases and the total number of points that had to be removed from all the phases. The next column is the percentage of total points that had to be removed. This was calculated by dividing the second column by the first (removed/total data points). The next step was to subtract the
percentage from 100, that percentage is the PAND score. PAND scores .60 and above indicates the study was at least somewhat effective (Parker et al., 2001). PAND scores were be put into one of four categories described by Scruggs and Mastropieri’s (1998) rubric for interpreting effect sizes. (Less than .5) non effective, (.5 to .69) debatably affective, (.7 to .89) moderately effective, and (.9 to 1) very effective (Lenz, 2013).

**Combining effect sizes.** In the case where articles with multiple qualifying studies reported multiple effect sizes, each treatment received one comparison. In studies using a method of withdrawal and alternating treatment, the treatment phases were compared with the previous baselines as in the studies with more than one treatment. If studies had multiple baselines, each baseline was compared to its treatment or treatments.

**Overall and disaggregated effect sizes.** To get an overall effect size, an Overall PAND was calculated. PAND = (total number of baseline points + total number of treatment points – total points removed in all the studies of a particular issue) / (total baseline points + total treatment points). For example, if all the studies had 1000 baseline, 900 treatment points and 100 points removed then PAND = (1000 + 900 – 100) / (1000 + 900) = 1800/1900 = 0.947. Overall RPhi worked by taking the numbers above and applying the formula previously described. A = (1000 – 50)/100 = 95%, b = c = 100/1900 = 5.3%, d = (900-50)/900 = 94%. 95/100.3 – 5.3/99.3 = 0.89.

To find the disaggregated effect sizes, an overall PAND, and robust Phi for each category of the disaggregation was calculated. For example, an overall PAND and robust Phi for all the studies which involve ages 11-13 and one for ages 14-22. That enables researchers to assess which interventions were effective for each age range.
To compare the effectiveness of different interventions, RPhi with the associated 95% confidence intervals were generated. Effect sizes were interpreted according to Phi coefficients using the following scale: RPhi 0.80-1.0 = “large effect,” RPhi 0.50-0.79 = “moderate effect,” RPhi coefficients between 0.20-0.49 = “small effect,” and those less than 0.20 = “negligible effect” (Cohen, 1998; Wery, 2012).

**Statistical comparisons of sensibly combined ESs.** Comparisons of sensibly combined ESs (e.g., self-monitoring ESs of kids age 11-13 vs 14-22; multiple baseline studies vs reversal design studies) were evaluated in two ways: (1) by checking the categories that the PAND score put the study into, and (2) by comparing the confidence intervals of the RPhi’s of the studies and the combined effect sizes.

**Chapter Summary**

In this chapter the procedures were outlined for how the researcher located studies and determined whether the studies were included or excluded in the final analysis. The coding procedures, independent variables, and reliability procedures were described. Finally, the methods were outlined that the researcher used to determine which studies had significant effects, the sizes of those effects, and how effect size comparisons were made across various studies were also described. Results are presented in chapter four; in Chapter five, findings are discussed in more detail as well as the implications of the findings on future research needs.
CHAPTER 4: RESULTS

In this chapter, results are presented to address the research questions of the study, which were: (1) (a) How effective are interventions for academic content knowledge learning designed to improve student skills and/or promote success in a specific content area) for students with HFA in the regular education setting? (b) How effective are the interventions for curriculum assistance learning (interventions designed to develop or enhance the participant’s skills with organization; study skills, test taking, and/or problem solving) for students with HFA in the regular education setting? (2) How effective are the interventions for appropriate behavior for students with HFA in the regular education setting? (3) How does effectiveness of interventions vary by study characteristics, interventions, and other variables?

In order to present the results of this meta-analysis responding to the research questions listed above, primary studies and their corresponding participants are described. Descriptive statistics on study characteristics are reported including publication source, year, research design, intervention dependent and independent variables, and outcomes. Effect size analyses are outlined using PAND and RPhi intervention effects for each of the independent variables analyzed.

Finally, intervention effects are evaluated by intervention category (academic content, curriculum assistance, social and/or behavioral skills). The results of this meta-analysis suggests many potential areas of difficulty including conflicts with behavior management, social barriers and the need to create inclusive educational climates conducive to learning. Further investigation is warranted about what interventions are effective for adolescent students with ASD (specifically for ages 11-21) in regular education setting.
Effect sizes are interpreted according to RPhi coefficients using the following scale: RPhi 0.80-1.0 = “large effect,” RPhi 0.50-0.79 = “moderate effect,” RPhi coefficients between 0.20-0.49 = “small effect,” and those less than 0.20 = “negligible effect” (Cohen, 1998; Wery, 2012).

**Publication Years.** Table 7 displays an overview of publication years of the 23 studies included in this analysis. The studies were published between the years 2000 and 2015 and appear to have increased over time: 2000 (n=1), 2003 (n=1), 2005 (n=1), 2006 (n=2), 2007 (n=4), 2009 (n=2), 2012 (n=5), 2013 (n=4), 2014 (n=1), and 2015 (n=2).

**Journals.** Table 8 represents an overview of the included studies in this analysis. The studies were published in 15 different journals: Assistive Technology (n=1), Behavior Modification (n=1), Education and Treatment of Children (n=1), Education and Training in Developmental Disabilities (n=1), Exceptionality (n=1), Focus On Autism and Other Developmental Disabilities (n=6), Journal of Applied Behavior Analysis (n=2), Journal Of Autism and Developmental Disorders (n=1), Journal of Positive Behavior Interventions (n=1), Preventing School Failure (n=2), Remedial and Special Education (n=1), Research and Practice For Persons With Severe Disabilities (n=1), Research in Autism Spectrum Disorders (n=2), Research on Social Work Practice (n=1), and The Journal of Special Education (n=1).

**Research Designs.** Table 9 represents an overview of the research designs reported in each of the included studies of this analysis. Most of the SCD studies used the multiple baseline across participants design (n=12), and there were 40 comparisons analyzed for this research design. Four studies used multiple baseline design across settings which resulted in 12 comparisons. Withdrawal or ABAB research designs were used in four studies which resulted in nine comparisons. Two studies used multiple baseline across behaviors which resulted in five
comparisons and alternating treatment design was used in one study which resulted in 15 comparisons.

**Intervention categories.** Data were collected on a multitude of variables in each of the 23 studies. Tables 15 through 19 present information about interventions in three categories: Interventions were designed to address dependent variables in three categories: academic content (n=6; k=15), curriculum assistance (n=6; k=17), and social behavioral interventions (n=12; k=46).

**Academic content.** Several interventions were utilized in this analysis. Six interventions were designed to address academic content by increasing academic content skill mastery (n=11; k=33). This included, (1) adult mediated interventions such as the use of character mapping to improve reading comprehension (n=6; k=11) and the use of a scripted program to improve math word problem skills (n=1; k=3); (2) preferred activity choice to increase multiplication facts (n=1; k=1), and (3) technology based interventions (spell check software) to improve spelling (n=1; k=1) and (video) to improve written language skills (n=1; k=2).

**Curriculum Assistance.** Although the structure and services of a Curriculum Assistance class varies according to school as well as county and state guidelines, for the purposes of this study, Curriculum Assistance is defined as a class for students with disabilities in which individualized assistance is given in academic core content as well as academic survival skills students need for success in school settings such as teaching organizational skills, test taking strategies, how to engage in academic discourse, group work and/or remediation for specific core classes related to student needs.

Of the interventions designed to teach students curriculum assistance skills (k=17), four
types of interventions were utilized: (1) multi-component adult mediated interventions used related to comprehensive function based analysis to increase time on task math performance (n=1); (2) peer mediated interventions were used to promote class participation (n=1); (3) self-management intervention (teaching problem solving strategy) to promote class participation (n=1), and two technology based interventions (personal digital assistant) to help with organization (n=2), and (4) video social stories to increase task completion (n=1).

**Social and behavioral interventions.** Of the 12 interventions designed to enhance student social and/or behavioral skills (k=46) by increasing appropriate behavior, decreasing inappropriate behavior (n=3; k=7) and/or improving social skills deficits (n=9; k=40), four types of interventions were utilized. (1) adult mediated intervention (high probability request sequencing) to improve transition time (n=1); (2) peer mediated interventions to increase social interactions (n=3) and decrease challenging behavior (n=1); (3) technology based interventions (Motivader) to decrease oral self-stimulation (n=1), video modeling to increase social interactions and improve perspective taking (n=1), and; (4) the use of social stories (n=2) to increase social interactions (see Table 17).

Table 18 presents more specific information about dependent variables in these studies to address inappropriate behaviors (n=1; k=3), academic social engagement (n=1; k=5), non-academic social engagement (n=9; k=40), on task behaviors (n=4; k=9), specific content skill mastery (n=4; k=13), and help with organization and study skills (n=3; k=8).

**Analysis by What Works Clearinghouse criteria.** All of the included studies in this meta-analysis were evaluated for study quality using the WWC pilot Single-Case Design Standards. It should be noted that meeting WWC criteria was not a deciding (exclusionary)
factor that was taken into consideration when screening eligible studies for this evaluation. The specific WWC criteria used to assess study quality of studies in this analysis are outlined in Table 18 as follows: (1) systematic manipulation of the independent variable in which the researcher determined how and when experimental conditions would change; (2) inter-assessor agreement systematically measured by more than one person in at least 20% of the data points in each condition, and the overall agreement met minimal thresholds (80-90%) (WWC, p.E.2); and (3) at least three attempts to demonstrate intervention effect at three different points in time. If studies met this first screening criteria, further analysis was conducted on the graphed data to determine if sufficient data points were noted in each phase in accordance with the research design (see Table 8).

Table 19 presents an overview of this quality evidence screening. Of the 23 studies used in this analysis, seven presented evidence associated with meeting WWC standards for single case design research. Of the 23 studies included in this analysis, approximately 20% met the standards (n=6), and about 25% (n=4) met standards with reservations. The remaining studies (n=13) did not meet the WWC standards outlined above (see Table 19).

**Withdrawal research designs.** Studies employing variations of the withdrawal design were determined to meet evidence standards if there were at least four phases demonstrating intervention effect with five data points per phase. They met standards with reservations if there were at least four phases demonstrating intervention effect with three data points per phase. Studies that did not meet these criteria were determined to have not met standards. Of the 4 studies that used withdrawal research design, only one presented evidence of meeting WWC standards, one met with reservations, and two did not meet these standards.
Multiple baseline research designs. Studies employing multiple baseline research designs were determined to have met standards if there were at least 6 phases demonstrating intervention effects with at least five data points per phase. Studies were determined to have met standards with reservations if there were at least 6 phases demonstrating intervention effects with at least three points per phase. Studies that did not meet these criteria were determined to have not met standards. Of the 18 studies that used multiple baseline research designs, five presented evidence of meeting WWC standards, four met with reservations, and nine did not meet these standards.

Alternating and simultaneous treatment designs. The studies using alternating and simultaneous treatment designs were determined to have met standard if each treatment demonstrating intervention effect had at least five data points. The studies demonstrating intervention effects with at least three data points per phase were categorized as having met standards with reservations. Studies that did not meet these criteria were determined to have not met standards. The one study that used multiple treatment research design did not meet these standards.

Intervention agents. Table 20 displays information related to intervention agents in this meta-analysis. Studies included in this analysis implemented by school staff members such as teachers, teacher assistants, administrators or other paid employees (n=5; k=16) as well as by non-staff members such as college students, researchers, volunteers, and non-disabled peers (n=11; k=28).

Eleven studies utilized both staff and non-staff members to implement the intervention, seven studies (k=28) did not indicate whether the intervention agents were staff or non-staff
members, and eight studies involved regular education peers to implement the intervention (k=40).

The number of intervention agents also varied among studies: one agent (n=5), two agents (n=7), three agents (n=5), five agents (n=1), eight agents (n=1), 30 agents (n=1), and 39+ agents (n=1). Two studies did not specifically report the number of agents, but it was indicated that there were at least three intervention agents in one study and greater than three agents in another study.

**Intervention settings.** The 20 included studies in this meta-analysis examined the effectiveness of interventions for 39 participants in 44 settings. Table 21 presents an overview of interventions settings reported in the 23 studies. Nineteen interventions were applied directly in the regular education classroom settings (k=25). Specific regular education classes were reported as follows: English class (n=5), math class (n=5), social studies class (n=3), science class (n=2), anatomy class (n=1), personal finance (n=1), Spanish class (n=1), and guitar class (n=1).

Nine interventions were applied in special education classroom settings (k=17); descriptions of those classes were reported as follows: resource room (n=5) and special education classroom (n=2). Two studies were not specific about the instructional setting, but the reported the intervention took place in a classroom (n=2).

Six interventions were applied in large and crowded settings such as the cafeteria (n=4) or hallway (n=2) which resulted in 21 comparisons. Nine interventions took place in the special education classrooms (k=17), and many of the settings did not offer clear details about their intervention settings (k=24); vague descriptions were: conference room (n=4), activity period (n=3), and office (n=2).

**Intervention length.** Intervention length was coded for each of the 78 comparisons. Of
the 23 studies included in this meta-analysis, intervention length varied (see Table 22). Twelve comparisons reported intervention data from one to seven days; 25 comparisons reported intervention data from eight to 14 days. Eighteen comparisons displayed intervention phases between 15-20 days, and 24 comparisons reported intervention data for 20 or more days.

**Interobserver Agreement (IOA)**

Inter-observer agreement (IOA) data were collected by a doctoral student and a volunteer regular education teacher to evaluate whether studies met or did not meet inclusion criteria on 40% of a random selection of studies included (n=10) and twice the same number of studies that were excluded (n=20) using the formula \([\frac{\text{number of agreements}}{\text{the sum of the number of agreements plus disagreements}} \times 100]\). Reliability was 100% on both inclusion and exclusion (deBruin, 2013).

The range for IOA for research report variables was 91-100%. The following report variables were collected: independent variable consistently manipulated 97%, number of intervention agents 91%, at least three attempts to demonstrate interventions with at least three data points in each phase 100%, inter-observer agreement overview (minimum of two observers, across phases, at least 20% of phases, acceptable percentages) 97%, generalization considered 91%, maintenance considered 100%.

The visual analysis of study data was reviewed for 78 comparison graphs. The range of IOA for data collection needed to determine PAND, RPhi and confidence intervals was 97-100%. Baseline data points in 78 comparison graphs was 100%, treatment data points noted in comparisons graphs was 99%, and overlapping data points identified in 78 comparison graphs was 97%.

**Effect Sizes**
Overall PAND and Overall RPhi. Table 6 represents individual study effect sizes as well as effect sizes for all the comparisons included in this meta-analysis. The overall PAND for all comparisons was 89.7% and the overall RPhi coefficient was 0.59; these effect sizes indicate interventions used with adolescent students with HFA in regular education settings can result in a significant effect.

Outcomes by research design. Table 9 presents effect size information outlining four studies and 78 comparisons by research design. Overall RPhi coefficients indicate studies employing multiple baseline research designs across settings (n=4; RPhi=0.83) and participants (n=12; RPhi=0.83) resulted in strong effect sizes. Moderate effects were noted for studies using withdrawal research designs (n=4; R PHI=0.67) and multiple baseline across behaviors (n=2; RPhi=0.80). The one study using multiple treatment design resulted in a low effect size of (0.43).

Outcomes by participant sex and race. Table 10 presents effect size data according to student demographics. There was no difference in effect size between males and females. However, fewer females (n=4; k=10) were included in the study than males (n=35; k=68). Of the 39 participants for whom race was reported, intervention effect sizes were most significant for Hispanic students (n=2; k=8) and those of unreported race (n=25; k=39). Marginal effects were noted for African American students (n=11; k=27), Caucasian (n=8; k=21), and biracial (n=1; k=4).

Outcomes by participant age and grade level. Students between the ages of 11-12 years old demonstrated the strongest effect sizes. Studies involving students between the ages of 15-18 resulted in significant effect sizes (RPhi coefficient range 0.80-0.82). These results are in line with the participant’s grade levels. All students in grades six, nine, ten, eleven and twelve
demonstrated stronger effect sizes, while effects were moderate for students in grade 7 and 8 (n=17; k=34; RPhi=0.74).

**Outcomes by participant intellectual ability.** Very small differences were found between the large effect sizes for students with unknown cognitive abilities (0.85) and those with above average abilities and/or Asperger syndrome diagnosis (0.82). Moderate effect sizes were noted for students with average abilities (0.73), and smaller effect sizes were noted for students whose exact IQ scores were reported (.65-.80). Moderate effects were noted for students whose reported IQ scores ranged 78-89 (0.65).

**Outcomes by autism diagnosis criteria.** Table 11 displays information about intervention effect sizes for students with HFA diagnosed with autism via different methods. Large effect sizes were noted as follows: students diagnosed by school based teams (n=4; k=7; RPhi=1.0), and students diagnosed via private or other independent evaluations (n=7; k=11; RPhi=0.97). Students diagnosed via physician and/or DSM (n=14; k=29; RPhi=0.77), and those students whose diagnosis method was unknown (n=14; k=32; RPhi=0.73) demonstrate moderate effect sizes.

**Outcomes by special education settings.** Of the 44 special education service delivery settings coded, the greatest effects were associated in conjunction with specific core content classes. Interventions for students with HFA in special education content classes consisting of only special education students such as social studies (0.94), English (0.89), math (0.89), science (0.88) as well as those of students whose special education was not clearly described (0.85) resulted in large effect sizes. Interventions for students served in curriculum assistance (0.72) as well as students served in special education classes most of the day (0.60) resulted in moderate effect sizes (see Table 12).
Table 14 offers additional information related to the intensity of special education services of students included in this analysis. The effect sizes were larger for students who received more support from special education services: two special education classes (0.89), and three or four special education classes (0.88). Moderate effects were calculated by students who received paraprofessional assistance (0.77).

**Outcomes by regular education settings.** Tables 13 and 14 represent effect size comparisons of students served in varied regular education settings. Of the 64 regular education service delivery settings coded, the greatest effects were associated in conjunction with elective classes (1.0). Large effects were noted for students in regular education math (0.87) as well as those in unspecified mainstream or inclusion classes (0.86). Moderate effects were noted when used in regular education science class (0.75), English classes (0.78), and social studies classes (0.74).

Moderate effect sizes were also noted for students with HFA described as participating in regular education classes for most or all of the day (0.72). Large effect sizes were noted for students served in two (0.94), four or five (0.94) regular education classes demonstrated large effect sizes. Moderate effect sizes were revealed for students participating in one (0.74) and three (0.60) regular education classes.

**Outcomes by intervention setting.** Of the 43 different intervention settings, moderate effects resulted when the study did not specifically indicate exactly where the study took place (n=9; k=24; RPhi=0.77) and in studies implemented in the student’s regular education classroom (n=19; k=25; RPhi=0.72). Moderate effects were also noted by studies taking place in the special education classroom (n=9; k=17; RPhi=0.70) or other areas such as the cafeteria and/or school hallway (n=6; k=21; RPhi=0.79).
Outcomes by intervention agent and length. Table 20 displays information related to intervention agents in this meta-analysis. Interventions used with five students with HFA enrolled in regular education classes that were exclusively implemented by school staff members such as teachers, teacher assistants, administrators or other paid employees resulted in the highest effect sizes (0.89). Studies that included school staff as well as by non-staff members such as college students, researchers, volunteers, and non-disabled peers resulted in moderately strong effects (0.73). Studies involving non-disabled peers as intervention agents (0.79) and studies that did not report specific roles of intervention agents noted small effects.

Table 22 presents information related to intervention length. Strong effects were noted for comparisons (k=12) whose graphed data presented intervention and data collection occurred between one and seven days (0.86). Moderate effects resulted in comparisons (k=18) whose graphed data presented intervention data collection occurred between 15 and 20 days (0.78), and those whose graphed data presented intervention and data collection occurred between eight and fourteen days (0.78). Moderate effects were also noted for studies whose graphed data presented intervention and data collection occurred for 20 or more days (k=24; RPhi=0.79).

Outcomes by intervention category. Table 15 represents effect sizes of interventions by category. Five research teams conducted six studies for 13 adolescent students with HFA enrolled in regular education classes that were designed to improve specific core academic content by enhancing skill mastery; of the 10 students meeting inclusion criteria included in this meta-analysis, moderate effect sizes were demonstrated (0.76). Tables 16-18 present information about interventions in all three categories.

In the academic content category, three types of interventions were utilized. Adult mediated interventions such as the use of character mapping to improve reading comprehension,
using a universal problem solving program to improve math word problem skills, and interventions using preferred activity choices to teach multiplication facts resulted in large effect sizes (0.94). Moderate effect were noted by technology based interventions including the use of computer software to check spelling, as video modeling to encourage the use of action words, or the use of video modeling to assist students with adding functional essay elements and making revisions to improve written language skills resulted in moderate effect sizes (0.77).

Twelve research teams conducted 12 studies for 36 adolescent students with HFA participating in regular education classes that were designed to enhance student social and/or behavioral skills; of the 25 students meeting inclusion criteria included in this meta-analysis, large effect sizes were demonstrated (0.81).

In the social and/or behavioral intervention category, high probability request sequencing (1.0) to improve transition time and decrease the number of prompts needed to complete tasks and interventions using social stories (0.91) resulted in large effect sizes. Technology based interventions (Motivader) to decrease oral self-stimulation and video modeling to self-monitor behavior produced moderate effects (0.77).

Six research teams conducted six studies for eight adolescent students with HFA enrolled in regular education classes that were designed to teach students curriculum assistance skills such as how to work cooperatively with others and stay on task during instruction; of the eight students meeting inclusion criteria included in this meta-analysis, moderate effect sizes were demonstrated (0.59). Interventions designed to enhance organization and study skills resulted in moderate effect sizes (0.77). Moderate effects were also noted with interventions designed to improve on task (0.69) behavior in academic settings included peer mediated interventions to promote class participation, self-management intervention (teaching problem solving strategy) to
promote class participation, and technology based interventions (personal digital assistant) to help with organization and video social stories to increase task completion.

**Chapter Summary**

In this chapter, results were presented for this study’s research questions. On the basis of Overall PAND analyses of the single case research interventions implemented for students with HFA in regular education settings, the effect size is moderate (PAND 89.7%; RPhi 0.59). Interventions included in this meta-analysis designed to help students with HFA improve academic content knowledge learning in the regular education setting were moderately effective with many strong effects (0.76). Interventions included in this meta-analysis designed to assist students with HFA to teach skills needed for success in regular education classrooms (curriculum assistance) were also moderately effective (0.59). Interventions included in this meta-analysis designed to teach students with HFA appropriate behavior in the regular education settings were moderate; this includes interventions to decrease inappropriate behavior (0.63) and increase good behavior (0.69).

While interventions settings varied, overall PAND analyses suggest that those interventions implemented by school staff in regular education classrooms were more effective than those implemented in special education settings. However, interventions implemented in non-classroom areas of the school were just as effective as those implemented in the regular classroom. All interventions implemented in core academic content classes (English, math, science, social studies) resulted in large effect sizes. These interventions were most effective with students in grades 9-12 characterized as having average to above average intelligence and grade level content abilities.
CHAPTER 5: ANALYSIS AND SYNTHESIS

The number of students with HFA enrolled in regular education classrooms who struggle with meeting the academic and social demands of secondary settings is likely to continue to increase. The academic and developmental needs of these students are complicated by the fact that grade level ability often contributes the misconception by teachers and other service providers that these students are not interested in or do not “need” to develop effective communication skills and/or social interaction skills with others because the students with HFA are not able to interact with others. As a result, students with HFA are not leaving school with the academic and interpersonal skills they need for success in the adult world of work and social relationships.

Historically, the literature is lacking in empirical research about students with HFA (or their teachers) in regular education settings. The increased prevalence in conjunction with the poor school outcomes of students who are leaving schools unprepared to assume their roles as independent and productive citizens has motivated more researchers in the field of special education to engage in more research designed to address the needs of these students. A significant need remains for regular and special education teachers of these students to assess student needs and use evidence based interventions to address those needs.

The results of this meta-analysis indicate that interventions to improve learning in academic and content knowledge, curriculum assistance and social and/or behavioral skills can be used effectively with students with HFA participating in regular education. In this chapter results are discussed in relation to the study’s research questions. Next, interventions which were more effective with these students are reviewed. Finally, research implications, analysis of research design quality, and limitations of this meta-analysis are discussed.
How effective are interventions to improve learning in academic content knowledge for students with HFA in the regular education setting?

Outcomes of interventions for improving academic content knowledge. Chapter 4 reported findings from five research teams who implemented six interventions that produced moderate effect size statistics for interventions designed to help 10 students (k=15) with HFA improve academic content knowledge learning in the regular education setting. The RPhi coefficient of 0.76 is high on the moderate scale, however, the results should be interpreted with caution because there were so few studies which addressed specific academic needs of these students. Eighty-six percent of the interventions used in this category (high preference strategies, self-regulated strategy development, video modeling/task analysis, using a computer program to check spelling, video modeling in conjunction with story mapping) were relatively easy for students to learn to use and teachers to implement in the regular education setting.

The use of a scripted math procedures to teach math word problems resulted in a large effect (0.81). The scripted program also appears to be easy to teach and implement in regular education settings. These findings suggest a need for additional research in the effectiveness of practical interventions to teach or reinforce academic skills in secondary settings.

These results indicate that relatively simple interventions that can be used for students with HFA in potentially all content areas, and these interventions have the potential to be equally effective for non-disabled students. In fact, many of these interventions were simple and developed by regular classroom teachers for students with different needs. Exploring the possibility of soliciting intervention ideas that regular education teachers have developed (and implemented successfully to teach their own content) linked to addressing the needs of students
with HFA, would be an interesting next step in generating ideas for teaching core academic content knowledge.

How effective are the interventions for learning for students with HFA in the regular education setting?

Outcomes for curriculum assistance interventions. Six research teams implemented six interventions which resulted in moderate effect size statistics for interventions designed to help eight students (k=17) with HFA to improve organization, problem solving and on task behavior (curriculum assistance skill learning) in the regular education setting as evaluated in published studies of single case design research.

The effect size of this category of interventions was moderate. This is likely because one of the comparisons of a particular study was eligible for inclusion in this study as the other two comparisons were not because they did not take place in a school setting. The intervention that took place in the school setting had significant overlap between baseline and intervention. The resulting effect was small (0.41). However, the other five studies by five research teams for 7 students resulted in strong effects ranging from .80 to 1.0. Specific interventions involved teaching students to use individualized problem solving strategies to address identified areas of need. For example, a student was taught to use the acronym SODA (Stop, Observe, Decide, Act) to self-monitor and participate in cooperative learning strategies. As was the case with useful interventions in the previous category, these interventions were easy to use, and they could likely be used successfully with all students.

Other interventions were grounded in more formal assessments of need (full Functional Behavioral Analysis - FBA) and brief FBA to observe the behavior in different settings, determine the purpose or function of the behavior and develop a subsequent plan to address those
needs. Follow-up interventions included video social and personal-digital-assistants to improve organization skills and on task behaviors in different classes throughout the day. The final results were very strong even though the initial time investment was significant in these interventions because of the need to observe in multiple settings, interview key stakeholders and collaborate with a team to determine the function of the behavior and generate appropriate follow up strategies.

Given the requirement of IDEA to use FBAs and Behavior Intervention Plan (BIP) to develop meaningful plans for students who were not making progress, the evidence clearly supports the need to for IEP teams to take the time and make a sincere effort to utilize these tools as they are designed to be used. Although some characteristics are displayed by most students with HFA, no universal strategy will always work with every student. Therefore, interventions must be student focused.

The initial data collection and collaborative evaluation and decision making require a significant investment of time. However, if the result is development of an effective intervention plan, the initial time investment may result in less required time from stakeholders in the long run. In addition, these findings reinforce the benefits of collaboration with others who can provide insight into a student needs. Researchers and service providers would be able to make more informed decisions about intervention plans, and those plans might be more successful if the intervention plan were developed and reinforced by others in different settings.

This does not necessarily mean that teachers must consistently take large amounts of time and effort to meet the needs of one student, but it does suggest that teachers must make the time to thoroughly assess student needs in order to subsequently develop interventions that have a greater chance of being effective with that student. The end result in these studies was that
implementing easy to use strategies such as teaching the student to use technology or designing a simple beginning-of-the-day agenda procedure can ultimately improve student performance across settings. Additionally, each of these studies reported data that indicated skills were maintained after the study’s conclusion.

**How effective are the interventions for appropriate behavior for students with HFA in the regular education setting?**

Interventions designed to increase social interaction and appropriate behavior resulted in produced strong effect sizes. A great variety of interventions were used in this category.

**Outcomes for social and behavioral interventions.** Twelve research teams implemented 12 interventions which resulted in strong effect size statistics for interventions designed to help 25 students (k=46) with HFA improve social and/or behavioral skills in academic and non-academic situations in the regular education setting as described in published studies of single case design research. Five types of interventions utilized adult mediated intervention (high probability request sequencing), peer mediated interventions and technology based interventions (Motivader) and video modeling and social stories.

These findings support previous research indicating technology based interventions, and those that include the involvement of non-disabled peers had strong effects and were supported with maintenance data (when reported). Interventions designed to help students develop skills for appropriate social interaction in non-academic settings were more successful than those whose desired outcome were to help students develop social skills in academic settings.

What was most exciting about the interventions used in this category was the engagement of non-disabled peers in the interventions. While overall peer interventions resulted in a moderate effect (0.79), it was very close to an overall large effect. The reason the final result was
moderate was related to a multi-component intervention involving many assessed behaviors (overall interaction, initiations, responses and continuations) of students with HFA and their non-disabled peers across settings for an extended period of time.

Although the non-disabled peers involved in this study were trained and motivated to use different interventions, concerns existed about whether just communicating with peers and asking them to consider making a choice to interact more with students who have HFA in different settings contributed to study results. However, this does not necessarily have to be a limitation. Of course, ethical considerations emerge when sharing information about a specific disability type with non-disabled peers, but it seems worthwhile to inform regular education of an effective and readily available resource (non-disabled peers). Additional exploration of the potential benefits of asking peers to be aware of the needs of students with disabilities and asking them to consider doing more than they would normally do to address that need (in class as well as in unstructured settings) offers a wealth of possible intervention possibilities for this population of students.

How does effectiveness of interventions vary by study characteristics, interventions, and other variables?

Outcomes by research design. Research designs may have contributed to the overall effectiveness of interventions. Studies employing multiple baseline designs resulted in larger effects than multiple treatment designs. While it is certainly understandable why a researcher may want to use this design, it can be a challenge to implement multiple treatment research designs to ensure that each treatment condition is separate and one intervention emerges as most effective. The effectiveness of this design is contingent on immediacy of effect, and the design
poses potential limitations (Kazdin, 2011) if at least one of the outcomes is to support the reliability and validity of an interventions effectiveness.

**Outcomes by study quality.** It should be noted again that none of the studies in this meta-analysis were individually analyzed to determine whether they fully met WWC standards. However, the quality of each study was assessed based on much of the WWC pilot single case design standards outlined in version three of the WWC procedures and standards handbook (see Table 4).

As is to be expected with SCD research, the quality of evidence presented in studies included in this meta-analysis varied considerably. A study’s evidence of meeting WWC standards was not consistently related to effect size. Six studies by six research teams to address the needs of 10 students met standards, and their effect was moderate (0.76). Four studies by four research teams to address the needs of eight students met standards with reservations, and their effect size was also moderate (0.78). Thirteen studies designed by 12 research teams to address the needs of 22 students, did not meet standards, but their effect size was large (0.80). Many of these studies did not meet standards because the evidence presented was vague or even missing.

For example, many studies reported data for IOA for 20% or more of all sessions, but they did not specifically clarify that at least 20% of IOA data were collected in both baseline and intervention phases. Others did not specify how many people observed or how researchers made planned decisions about phase changes. Ensuring that appropriate numbers of data points were demonstrated in the graph was another factor that contributed to poor overall evaluations for some studies. The obvious solution is to be aware of these best practices and include them into written descriptions of research designs. Authors must include this information in their
manuscripts to support their findings and contribute to the validation of single case research design findings.

**Outcomes by setting and intervention agent.** The interventions implemented in regular education settings were more effective than those implemented in special education classrooms. This finding supports the need to consider relevance, generalization (a participant’s ability to apply newly learned skills in varied settings) and maintenance when planning an intervention. Teaching students with HFA skills in isolation was not as effective as treatments applied in real world settings. Educators should be mindful of this finding and consider making other key stakeholders in the student’s life aware of specific efforts to address an identified student need resulted in greater effects and stronger social validity ratings.

In addition, including school staff and others (related service providers, parents, case managers, etc.) who know the student in the treatment interventions was associated with increased effects. The success of interventions that were implemented in regular education electives (e.g., guitar or art classes) is noteworthy because the needs of students in non-essential classes are often overlooked; however, applying treatments in such settings was very effective.

**Outcomes by special education service delivery.** Although all students in this meta-analysis were reported to have been served by special education, making a judgment about the effectiveness of special education services is difficult because most studies (n=27; k=40) did not provide details about the frequency or intensity of special education support. Omitting this readily available information is a serious limitation in assessing the effectiveness of special education support with these students.

Keeping in mind that eligible students were determined to have the intellectual ability to meet academic expectations, very few students were served in special education core content
classes. Students with higher intelligence responded very positively to interventions. This again reinforces the idea of environmental fit between the student and the instructional setting. If students feel lessons are relevant, and have a reason to attend school, they are more likely to be successful. The special education class (which contained only special education students) that was most frequently reported was English Language Arts (strong effect), and that is consistent with language delays and communication skills often associated with students diagnosed with autism. This would suggest that IEP teams and case managers should consider the need for additional support in this area when making decisions about appropriate service delivery. Students need to be served in the least restrictive environment and meet graduation requirements. However, there are potential communication deficits which can create barriers to success in regular education settings.

Students with HFA struggle the most in the areas of – expressive and receptive language deficits (nuances of language, figurative language, understanding different perspectives, complex sentences, putting thoughts into words, oral language, organized writing and application of basic grammar concepts understanding). These students may need additional assistance in English Language Arts to develop effective communication and social interaction skills. If students are served in the regular education classes, IEP teams may consider regular assessments/progress monitoring and the potential need for supplemental support in this area.

Given the need for teachers to be highly qualified in regular education subject areas in secondary educational settings in conjunction with the push for students to be served in the least restrictive environment, additional support in this area is worthy of discussion by IEP teams. It should also be noted that four studies reported additional assistance in the form of a paraprofessional in regular education settings, and the effect sizes for those students were larger
than those who did not report additional one on one assistance. Of course, this interpretation is limited by the fact that the studies that did not report the support of a paraprofessional assistant may have simply failed to report that fact. Therefore, it is difficult to really assess how many students had additional support. Again, this information is readily available and worthy of reporting in research manuscripts.

The effects of interventions applied in large and crowded settings were close to being considered strong effects (0.79). It is important to consider the reasons behind these setting choices. In studies conducted in such settings, students demonstrated considerable need to develop appropriate coping and social engagement skills in order to independently manage their emotions and decisions. It is encouraging that researchers are considering both the academic and social needs of this group of students who are typically isolated and unsuccessful in large environments. Finding more effective interventions to address student needs in large, multi-sensory environments is another research need.

**Research Implications**

Results of this analysis are consistent with existing literature. Students with HFA in the regular education setting are in need of educators who use effective teaching practices to maximize their potential for success. Interventions considered in this study support the general needs outlined in research. The interventions need to address student academic challenges, curriculum assistance as well as social and behavioral needs. The significant number of intervention studies excluded because the participants were too young or because the participants did not have the intellectual ability for success in regular education classes reinforces the need for additional studies of interventions for adolescent students with HFA in regular education settings.
The scarcity of information available for students in specific demographic categories is also a concern. Only four participants were female (10%), and race was not reported in 64% of the studies. Of the studies that did report race, most participants were Caucasian (85%), and other populations were underrepresented in this analysis: African American (8%), Hispanic (1%). This issue could be resolved by researchers simply including this information in manuscripts. In addition, it would be interesting to explore more potential explanations for why more Caucasians with HFA are included in regular education classes if that really is the case. Perhaps non-Caucasian students with similar needs in those settings are misdiagnosed.

The participants in almost half (44%) of these studies were between the ages of 13-14 years old and in eighth grade. However, the effectiveness of interventions for this relatively large sample of studies was smaller than for students described as being both younger and older than this specific group. More research is needed related to the socio-developmental and academic needs of this population of students with HFA who are younger than 13 or older than 14 and placed in regular education settings.

Future researchers should consider offering detailed demographic data about participants related to age, race, setting and service delivery. Demographic information is critical to understanding research results. Meta-analysis techniques used in conjunction with ABA studies can help to consider the influence of demographics such as race, gender, etc. on research outcomes.

More information is also needed about core subject areas in regular education in which students may be experiencing difficulty so that researchers can focus on developing and utilizing content specific interventions for middle and high school students. If educators and service
providers in the lower grades understood the most significant challenges of adolescents in secondary settings, they could begin to help students develop these skills at a younger age.

Much is to be learned about the challenges of teachers and students of HFA in regular education settings. The results of this meta-analysis suggest many areas of difficulty including conflicts with behavior management, social barriers and the need to create inclusive educational climates conducive to learning. Further investigation is needed concerning what interventions are effective for adolescent students with ASD (specifically for ages 11–21) in regular education setting.

All of the studies in this analysis that did relate to social and behavioral interventions noted the very real connection between academic demands in regular education and inappropriate behaviors. In fact, the underlying purpose of the studies was to help students develop the skills they needed to participate more in regular education curriculum classes. Researchers need to learn more about what can help students with HFA develop the social and behavioral skills required as they progress through their education into the world of work and adult relationships.

Future research should investigate how many students with HFA who have the intellectual skills to be successful in regular education are being served in less restrictive settings (in other words, how many students with the intellectual ability to master regular education content are being served in special education classes) because they lack the social and/or behavioral skills they need to interact effectively with others in those settings.

**Limitations**

The most obvious limitation to this research is the relatively small number of research studies available related to evidenced based interventions designed to meet the needs of
adolescents with HFA in regular education settings. Given the purpose of this study was to identify effective interventions for students with average intelligence, the wide range of intellectual abilities included in this study is a limitation. For this analysis, an IQ score of at least 76 was used as the lowest score considered for inclusion as “high functioning,” but the lowest score of the included participants in this study was 78.

The decision to expand the definition of “high functioning” was made in consideration of the shortage of relevant studies and as well as the Childhood Autism Rating Scale (CARS) manual which uses a cutoff of 80 to distinguish between high and low functioning. Given that very few of the studies reported specific assessments used to determine intellectual ability, and the fact that all standardized assessments have a degree of error associated with them, the potential range of scores associated with an 80 IQ was used (at least 76).

Full scale IQ tests generally have at least a few points error (Schopler, Reichler, & Renner, 2002). Therefore, IQ ranges of 76-84 were included in the average range for this study. Students with IQ scores <76 are also less likely to be served in regular education settings. Students described as having average or above average intellectual abilities were included in this study because the focus is on HFA.

An additional reason for including students with IQ scores somewhat lower than average was to address the needs of students with autism participating in regular education classes. The purpose of this study is to identify all possible interventions and/or strategies that regular education teachers may use to meet the diverse needs of students with HFA enrolled in their classes. The analyses in this study included one participant with an IQ of 78, one with an IQ of 83, and one with an IQ of 84. The remaining IQs were within one standard deviation of the average IQ score. However, it should be noted that a student with an IQ of 78 would likely need
to be a motivated learner with a strong support system in order to learn grade level concepts in regular education classes as well as much review and practice with corrective feedback to reinforce new learning.

Researchers did not specify IQ scores for 24 participants. Specific IQ scores were not reported for 49% of the participants. Most of the participants met criteria because they were identified as having Asperger Syndrome or described as having at least average or grade level abilities. This inclusion criteria is both ambiguous and subjective because one person’s conception of grade level or average abilities may differ significantly from another’s interpretation. Specific information about student abilities documented in each study would alleviate this limitation in future studies.

The studies that did meet inclusion criteria were primarily focused on social and behavioral needs of students with HFA rather than on the academic needs of those students. When describing participant characteristics, on-task behaviors in regular education classrooms and a need to develop organization and study strategies were consistently mentioned by researchers. The few studies that were available which concentrated on academic needs, focused more on tasks related to English Language Arts that support the language and/or communication challenges of students with ASD. However, only two content area strategies related to math, one to reading comprehension and three related to improving written language skills.

This meta-analysis contains many limitations which may be related to the search procedure and generalizing results to the larger population. While the electronic literature search was extensive, it is conceivable that the large number of search descriptors excluded articles that may have been applicable. Although two additional volunteers were recruited to assist with data accuracy, bias could play a part in determining the study’s effect size. Relevant articles could
have been excluded if they were not written in English, did not focus on students served in the regular education setting within the stated age range and range of publication years. The majority of available studies are associated with the needs of students who were younger or older (over 22) than the participants in this analysis. Some appropriate interventions that have been proven effective with students outside this age range may offer valuable information to educators, families and other service providers.

Studies that did not employ single case design may have contained relevant information but were not considered in this analysis. In addition, AB studies were not considered in this analysis. While the AB studies did report positive changes for participants, they offer little or no evidence that the intervention caused the change in behavior. Studies employing medical interventions and studies that did not include graphed data necessary to calculate PAND and RPhi were excluded. Consequently, the results of this analysis may not be readily generalizable to the general population of all adolescent students with ASD served in general education settings. Therefore, caution should be taken in generalizing these results to the larger population of students with HFA in general education settings.

**Effect size analysis.** As was stated in Chapter 3, several other method options are available to evaluate effect size in SCD research. Although PAND was used to calculate effect size in this study, there are other types of non-overlap methods that could also be used for this purpose such as: (e.g., ELC (split middle line), PND (percentage of non-overlapping data), PAND (percentage of all non-overlapping data), PEM (percentage of data points exceeding the median), IRD (improvement rate difference), NAP (non-overlap of all pairs), and Taunovlap (Kendall’s tau nonoverlap) – (Parker, Vannest, & Davis, 2011).

The rationale for using PAND was this method is easy to use and researchers can
distinguish between minimally effective treatments and very effective treatments. In addition, PAND can be paired with RPhi to establish confidence intervals for the quantity being measured. Confidence intervals enable researchers to interpret the PAND and PPhi results with more confidence because they provide a range of values that 95% of the time capture the true value of the parameters being measured.

They are important in a study that generates and evaluates effect size because they confirm the value of the measured parameter. Using this method can produce wide confidence intervals. Interpreting effect can be problematic in cases in which the confidence interval range covers more than one of the effect size categories (e.g., small, moderate and large). The disadvantage of this method is that it does not take a trend or effect magnitude into account and thus a treatment’s effectiveness can be overestimated or an ineffective treatment can be thought to be effective, due to an effect that may have occurred naturally overtime (Parker et al., 2007; Parker et al., 2011).

**Conclusion**

These findings suggest that interventions designed to help adolescent students with HFA develop specific academic, organizational and social/behavioral skills can be effective. The most successful strategies were based on a functional analysis of student need and implemented by people familiar with the student in natural settings in which the student typically interacted. The use of non-disabled peers and technology were among the most promising interventions. This meta-analysis identified many areas of need that could be explored in further research.

The interventions described in the included published studies of single case design research treatments for adolescent students with HFA in regular education settings were effective in addressing academic content, curriculum assistance skills as well as social and behavioral
skills. However, research is limited that addresses related to the needs of students with HFA in regular education settings.

The many advances in technology in recent years make technology readily accessible to students and educators. Exploring the many electronic applications that help with organization, study skills and problem solving could be a valuable self-monitoring tool for students with HFA. Further research should explore other types of interventions that address the communication and social deficits of these students as they progress through middle and high school.

The fact that these interventions were simple and potentially beneficial to other students suggests some interventions can prove to be effective with other populations that might also be effective for these students with HFA. More information is needed to determine specific strategies which may prove useful for these students within this age range and setting.
References:


Parker, R. I., & Vannest, K. (2009). An improved effect size for single-case research:


Appendices
Appendix A (Tables)

Table 1

Comparison of Autism Diagnosis Criteria (DSM IV and DSM V)

<table>
<thead>
<tr>
<th>DSM IV Diagnostic Criteria for Autistic Disorder</th>
<th>DSM V Diagnostic Criteria for Autistic Disorder</th>
</tr>
</thead>
<tbody>
<tr>
<td>(I) A total of six (or more) items from (A), (B), &amp; (C), with at least two from (A), &amp; one each from (B) &amp; (C)</td>
<td>(A) Persistent deficits in social communication &amp; social interaction across multiple contexts, manifested currently or by history:</td>
</tr>
<tr>
<td>(A) social interaction deficits, at least 2:</td>
<td>1. social-emotional reciprocity</td>
</tr>
<tr>
<td>1. impairments in nonverbal behaviors</td>
<td>2. nonverbal communicative behaviors</td>
</tr>
<tr>
<td>2. lack of spontaneous seeking to share enjoyment, interests, or achievements</td>
<td>3. developing, maintaining, &amp; understanding relationships</td>
</tr>
<tr>
<td>3. lack of spontaneous seeking to share enjoyment, interests, or achievements</td>
<td>4. current severity: <strong>social communication impairments &amp; restricted repetitive behavior</strong></td>
</tr>
<tr>
<td>4. lack of social or emotional reciprocity</td>
<td>(B) Restricted, repetitive patterns of behavior, interests, or activities in at least 2:</td>
</tr>
<tr>
<td>(B) qualitative impairments in communication in at least 1:</td>
<td>1. Stereotyped or repetitive motor movements</td>
</tr>
<tr>
<td>1. delay or lack of spoken language</td>
<td>2. Inflexible adherence to routines, or ritualized patterns or verbal nonverbal behavior</td>
</tr>
<tr>
<td>2. initiate or sustain a conversation</td>
<td>3. Highly restricted, fixated interests abnormal in intensity or focus</td>
</tr>
<tr>
<td>3. stereotyped &amp; repetitive use of language or idiosyncratic language</td>
<td>4. Hyper- or hyporeactivity to sensory input or unusual interests in sensory aspects of the environment</td>
</tr>
<tr>
<td>4. lack of spontaneous play</td>
<td>(C ) Symptoms present in early developmental (may not manifest until later)</td>
</tr>
<tr>
<td>(C) restricted repetitive &amp; stereotyped patterns of behavior, interests &amp; activities in at least two of the following:</td>
<td>(D) Significant impairment in social, occupational, or other areas of functioning.</td>
</tr>
<tr>
<td>1. preoccupation with 1 or more stereotyped &amp; restricted patterns of interest</td>
<td>(E) Disturbances not explained by intellectual disability or dev delay</td>
</tr>
<tr>
<td>2. inflexible adherence to specific, nonfunctional routines or rituals</td>
<td><strong>Note:</strong> keep established diagnosis of autistic disorder, Asperger’s disorder, or PDD-NOS</td>
</tr>
<tr>
<td>3. stereotyped &amp; repetitive motor mannerisms</td>
<td>Social Communication Disorder</td>
</tr>
<tr>
<td>(II) Delays or abnormal functioning in at least one of following, (onset prior to 3 yrs):</td>
<td></td>
</tr>
<tr>
<td>(A) social interaction</td>
<td></td>
</tr>
<tr>
<td>(B) language as used in social communication</td>
<td></td>
</tr>
<tr>
<td>(C) symbolic or imaginative play</td>
<td></td>
</tr>
<tr>
<td>(III) The disturbance is not better accounted for by Rett's Disorder or Childhood Disintegrative Disorder</td>
<td></td>
</tr>
</tbody>
</table>
### Table 2

*Reviews of Interventions for Students with Autism*

<table>
<thead>
<tr>
<th>Pub. Yr.</th>
<th>Journal &amp; Impact Factor</th>
<th>Author(s)</th>
<th>Topic</th>
<th>Format (LR, SR, MA)</th>
<th>Public School Setting</th>
<th>Reg Ed Focus</th>
<th>Category (AC, CA, SB)</th>
<th>Setting (Primary or Secondary)</th>
<th>Rsrch Years</th>
<th>Ability (High, Low, Both, NS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>Review of Educational Research (3.897)</td>
<td>de Bruin, Deppeler, Moore &amp; Diamond</td>
<td>Public School-Based Interventions for Adolescents and Young Adults</td>
<td>MA</td>
<td>Yes</td>
<td>CA; SB</td>
<td>S</td>
<td>1986-2013</td>
<td>Not stated</td>
<td></td>
</tr>
<tr>
<td>Year</td>
<td>Journal Title</td>
<td>Authors</td>
<td>Title</td>
<td>MA</td>
<td>SB</td>
<td>P &amp; S</td>
<td>Year Range</td>
<td>Notes</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>2012</td>
<td>Behavior Modification (1.605)</td>
<td>Crosland &amp; Dunlap</td>
<td>Strategies for the inclusion in general education</td>
<td>LR</td>
<td>Yes</td>
<td>Yes</td>
<td>AC; CA; SB</td>
<td>P &amp; S</td>
<td>-</td>
<td>Not stated</td>
</tr>
<tr>
<td>2012</td>
<td>Assistive Technology (1.679)</td>
<td>Ganz, Earles-Vollrath, Heath, Parker, Rispoli, &amp; Duran</td>
<td>Single case research studies on aided augmentative and alternative communication systems</td>
<td>MA</td>
<td>AC; SB</td>
<td>P &amp; S</td>
<td>Not stated</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>Research in Autism Spectrum Disorders (2.212)</td>
<td>Lequia, Machalicek, &amp; Rispoli, M. J.</td>
<td>Activity schedules on challenging behavior</td>
<td>LR</td>
<td>SB</td>
<td>P &amp; S</td>
<td>Not stated</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year</td>
<td>Field</td>
<td>Authors</td>
<td>Title</td>
<td>Study Type</td>
<td>Evaluators</td>
<td>Year</td>
<td>Effect Size</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>--------------------------------</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>Education &amp; Training in Autism &amp; Developmental Disorders (0.907)</td>
<td>Mayton, Wheeler, Menendez &amp; Zhang</td>
<td>Analysis of evidence-based practices in the education and treatment of learners</td>
<td>LR</td>
<td>P &amp; S</td>
<td>1997-2011</td>
<td>Not stated</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>Focus on Autism &amp; Other Developmental Disabilities (1.265)</td>
<td>Pennington</td>
<td>Computer-assisted instruction for teaching academic skills</td>
<td>LR</td>
<td>AC; SB</td>
<td>P &amp; S</td>
<td>Low</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>Remedial &amp; Special Education (1.742)</td>
<td>Bellini, Peters, Benner &amp; Hopf</td>
<td>School-based social skills interventions</td>
<td>MA</td>
<td>Yes</td>
<td>SB</td>
<td>P &amp; S</td>
<td>2000-2013</td>
<td>Not stated</td>
<td></td>
</tr>
</tbody>
</table>
Table 3

Codification of Independent and Dependent Variables

<table>
<thead>
<tr>
<th>Study characteristics</th>
<th>Coding description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study identification</td>
<td>study number, author, publication date, number of graph comparisons</td>
</tr>
<tr>
<td>Research design</td>
<td>1 = withdrawal</td>
</tr>
<tr>
<td></td>
<td>2 = multiple baseline across participants</td>
</tr>
<tr>
<td></td>
<td>3 = multiple baseline across settings</td>
</tr>
<tr>
<td></td>
<td>4 = multiple baseline across behaviors</td>
</tr>
<tr>
<td></td>
<td>5 = multiple treatment</td>
</tr>
<tr>
<td>Study quality indicator 1: analysis of IOA</td>
<td><em>IOA recorded on at least 20% of observations in each phase</em></td>
</tr>
<tr>
<td></td>
<td>1 = yes, study did meet this criteria</td>
</tr>
<tr>
<td></td>
<td>2 = no, study did not meet this criteria because it was not stated or unclear description to confirm this requirement</td>
</tr>
<tr>
<td>Study quality indicator 2: visual analysis of evidence in phase repetitions</td>
<td><em>IOA meets minimum threshold standards</em></td>
</tr>
<tr>
<td></td>
<td>1 = yes, study did meet this criteria</td>
</tr>
<tr>
<td></td>
<td>2 = no, study did not meet this criteria because it was not stated or unclear description to confirm this requirement</td>
</tr>
<tr>
<td>Study quality indicator 2: visual analysis of evidence in phase repetitions</td>
<td><em>Withdrawal design</em></td>
</tr>
<tr>
<td></td>
<td>meets standard = at least four different phases with five data points per phase</td>
</tr>
<tr>
<td></td>
<td>meets with reservation = at least four different phases with three data points per phase</td>
</tr>
<tr>
<td></td>
<td>does not meet this standard</td>
</tr>
<tr>
<td>Study quality indicator 2: visual analysis of evidence in phase repetitions</td>
<td><em>Multiple baseline design</em></td>
</tr>
<tr>
<td></td>
<td>meets standard = at least six different phases with five data points per phase</td>
</tr>
<tr>
<td></td>
<td>meets with reservation = at least six different phases with three data points per phase</td>
</tr>
<tr>
<td></td>
<td>does not meet this standard</td>
</tr>
<tr>
<td>Study quality indicator 2: visual analysis of evidence in phase repetitions</td>
<td><em>Alternating or continuous treatment design</em></td>
</tr>
</tbody>
</table>
meets standard = each treatment has at least five data points per phase
meets with reservation = each treatment has at least three data points per phase
does not meet this standard

Study quality indicator 3: Intervention fidelity
evidence of intervention 1 = yes
fidelity, generalization 2 = no
and maintenance Generalization
integrated into study 1 = yes
implementation 2 = no
Maintenance
1= yes
2= no

Study quality indicator 4: 1= study meets criteria stated above
What Works 2= study meets criteria stated above with reservation
Clearinghouse Evidence 3 = study does not meet criteria stated above
Evaluation
Intervention category AC = academic content
(Independent variables) CA = curriculum assistance
SB = social and/or behavior

Intervention outcome 1 = increase or enhance social interaction skills
category 2 = increase or enhance academic skills
3 = decrease inappropriate behaviors
Dependent variable 1 = inappropriate behavior
categories 2 = academic social engagement
3 = nonacademic social engagement
4 = on task behaviors
5 = academic content mastery
6 = curriculum assistance
Intervention setting 1 = special education classroom or resource classroom
                                                    2 = regular education classroom
                                                    3 = cafeteria
                                                    4 = hallway or other crowded area
                                                    5 = other area in the school during the school day
                                                    other

Intervention agent 1 = school staff
                                                    2 = non-staff
                                                    3 = combined staff and non-staff
                                                    4 = unclear

Intervention length 1 = 1-7 intervention sessions reported and data collected
                                                    2 = 8-14 intervention sessions reported and data collected
                                                    3 = 15-20 intervention sessions reported and data collected
                                                    4 = 20+ intervention sessions reported and data collected

Participants and setting
Demographics name
                                                    age
                                                    grade
                                                    gender (1= male, 2= female)
                                                    race (1= white; 2= black; 3= Hispanic; 4= biracial; 5= not stated)

Autism diagnosis 1 = Diagnostic Statistical Manual – DSM diagnosis
                                                    2 = school based diagnosis
                                                    3 = private doctor/facility or other independent agency
                                                    4 = not stated how the participant was diagnosed with autism

Intellectual ability 1= grade level intellectual ability reported
                                                    2 = average or typical intellectual ability reported
                                                    3 = above average intellectual ability reported
                                                    4 = Asperger Syndrome diagnosis
                                                    5 = not stated but participant attends general education classes with description of grade level ability in text
<table>
<thead>
<tr>
<th>Regular education services</th>
<th>1 = student participates in inclusion/mainstream classes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2 = not specifically stated</td>
</tr>
<tr>
<td></td>
<td>3 = English language arts class in regular education</td>
</tr>
<tr>
<td></td>
<td>4 = math class in regular education</td>
</tr>
<tr>
<td></td>
<td>5 = social studies class in regular education</td>
</tr>
<tr>
<td></td>
<td>6 = science class in regular education</td>
</tr>
<tr>
<td></td>
<td>7 = elective class in regular education</td>
</tr>
<tr>
<td></td>
<td>8 = most or all of the day in regular education classes</td>
</tr>
</tbody>
</table>

Number of regular education classes

- exact count
- not stated

<table>
<thead>
<tr>
<th>Special education services</th>
<th>1 = resource room</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2 = curriculum assistance or study skills</td>
</tr>
<tr>
<td></td>
<td>3 = English language arts in special education</td>
</tr>
<tr>
<td></td>
<td>4 = math in special education</td>
</tr>
<tr>
<td></td>
<td>5 = science in special education</td>
</tr>
<tr>
<td></td>
<td>6 = social studies in special education</td>
</tr>
<tr>
<td></td>
<td>7 = other (unclear services)</td>
</tr>
<tr>
<td></td>
<td>8 = student served in special education part of the day</td>
</tr>
<tr>
<td></td>
<td>9 = student participates in special education most of the day</td>
</tr>
<tr>
<td></td>
<td>10 = social skills support in special education</td>
</tr>
</tbody>
</table>

One on one assistance noted in study

- 1 = yes
- 2 = no

Number of special education classes

- exact count
- not stated

**Data collection**

PAND calculation

- number of data points in baseline
- number of data points in treatment phases
- minimum data points that overlap

* = IQ scores of specific students used when reported
Table 4

*Quality of Evidence Coding Criteria*

<table>
<thead>
<tr>
<th>Study Characteristics</th>
<th>Evaluation Criteria</th>
</tr>
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<tbody>
<tr>
<td>Independent Variable</td>
<td>Independent variable systematically manipulated</td>
</tr>
<tr>
<td>Measurement of Dependent Variable</td>
<td>Dep variable repeated measured by more than one assessor</td>
</tr>
<tr>
<td>IOA agent(s)</td>
<td>&gt; 1</td>
</tr>
<tr>
<td>Inter-observer agreement (IOA)</td>
<td>IOA each outcome variable measured by &gt;1 assessor; each phase; evidence clearly states that at least 20% of data points in each condition; IOA minimum threshold</td>
</tr>
<tr>
<td>Demonstration of Intervention</td>
<td>At least 3 attempts to demonstrate intervention at 3 points in time in each phase</td>
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<tr>
<td>Sufficient Data</td>
<td>At least three data points in each phase</td>
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</tbody>
</table>
| Withdrawal Design     | *Meets Standard* = at least 4 phases; each phase has at least 5 data points per phase  
*Meets Standard with Reservations* = at least 4 phases; at least 3 data points per phase  
*Does NOT meet Standard* = less than 4 phases; less than 3 data points per phase |
| Multiple Baseline Research Designs | *Meets Standard* = at least 6 phases; each phase has at least 5 data points per phase  
*Meets Standard with Reservations* = at least 5 phases; at least 3 data points per phase |
\textit{Does NOT meet Standard} = less than 5 phases; less than 3 data points per phase

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
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<tbody>
<tr>
<td>Alternating &amp; Simultaneous</td>
<td>\textit{Meets Standard} = each treatment has at least 5 data points</td>
</tr>
<tr>
<td>Treatment Research Designs</td>
<td>\textit{Meets Standard with Reservations} = at least 3 data points</td>
</tr>
<tr>
<td></td>
<td>\textit{Does NOT meet Standard} = less than 3 data points</td>
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<tr>
<td>Graphed data</td>
<td>Data factors (trend, immediacy, variability; magnitude of effect)</td>
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<td>Effect size measurement</td>
<td>Effect size measurement (what, how implemented, results)</td>
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<td>Study features:</td>
<td>\textit{Intervention fidelity} (agent, method, reliability, frequency)</td>
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<td>\textit{Generalization} (agent, method, reliability, frequency)</td>
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<td>\textit{Maintenance} (agent, method, reliability, frequency)</td>
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<td>Interventions</td>
<td>At least 5 SCD studies of intervention that meet or meet with reservations</td>
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<td>Research Teams</td>
<td>At least 3 different research teams; 3 different institutions</td>
</tr>
<tr>
<td>Participants</td>
<td>Combined participants at least 20</td>
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<td>Citation</td>
<td>Intervention Category</td>
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<td>Banda, D. R., &amp; Kubina Jr, R. M. (2009)</td>
<td>Academic content mastery</td>
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<td>Banda, D. R., &amp; Kubina, R. M. J. (2006)</td>
<td>Social and/or Behavioral</td>
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<td>Author(s)</td>
<td>Journal</td>
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<td>Bock, M. A.</td>
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<td>Cihak, D. F., Kildare, L. K., Smith, C. C., McMahon, D. D., &amp; Quinn-Brown, L.</td>
<td>Curriculum Assistance</td>
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<td>Davis, K. M., Boon, R. T., Cihak, D. F., &amp; Fore III, C.</td>
<td>Social and/or Behavioral</td>
</tr>
<tr>
<td>Delano, M. E. (2007)</td>
<td>Academic content mastery</td>
</tr>
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</table>

| Delano, M. E. (2007) | Academic content mastery | 1 | increase number of action words | improve number of action words | number of action words | Self-Regulated Strategy Development was used to improve the academic functioning of students with Asperger syndrome to improve written language skills. |
| Ferguson, H., Myles, B. S., & Hagiwara, T. (2005) | Curriculum Assistance | 1 | increase percent of tasks completed independently | PDA use of calendar & reminders | tasks completion | A personal digital assistant was successfully used with a student with Asperger syndrome to begin and complete tasks at school and at home. The results indicate the PDA was effective in decreasing student reliance on adults to complete tasks. |
| Gann, C. J., Ferro, J. B., Umbreit, J., & Liaupsin, C. J. (2014) | Curriculum Assistance | 1 | increase on task behavior in science | Science (on task behaviors- easy reference expectations; list of daily tasks; modify tasks/pace; hands on activities; frequent praise) | playing with objects not related to tasks; talking to peers; blowing on peers; hiding under desk; lying across tables; picking at sores; showing blood to peers | A comprehensive function-based intervention was successfully applied across multiple regular education classrooms. Marked improvement in on task behavior was demonstrated in each classroom. |
| Ganz, J. B., Heath, A. K., Davis, J. L., & Vannest, K. J. (2013) | Social and/or Behavioral | 2 | decrease oral self-stimulation | self-monitoring device (technology) Motivaider | oral self-stimulation | A self-monitoring device (Motivaider) was successfully used by two middle school students with high functioning autism to increase on task behavior, reduce oral self-stimulation and increase appropriate conversations. |
Hughes, C., Bernstein, R. T., Kaplan, L. M., Reilly, C. M., Brigham, N. L., Cosgriff, J. C., & Boykin, M. P. (2013) Social and/or Behavioral increase social interactions communicatio n books increase social interactions Self-prompted communication books were effective when used in combination with conversational peer orientation to increase conversational interactions of high school students with autism.

Hughes, C., Harvey, M., Cosgriff, J., Reilly, C., Heilingoetter, J., Brigham, N., & ... Bernstein, R. (2013) Social and/or Behavioral increase number of social initiations peer delivered; self-monitoring (goal setting) social interactions Three regular education (non-disabled) high school students were successfully taught to set interaction goals and monitor interactions with a peer with autism in their classes. Results indicate an increase in social interaction among participating students.

Kagohara, D. M., Sigafoos, J., Achmadi, D., O’Reilly, M., & Lancioni, G. (2012) Academic content mastery increase correctly performed steps to check spelling task analysis; technology to help check spelling check spelling of words Video modeling was successfully used with two students with autism to check the spelling of words using the spell check function on common word processing programs. Results indicate video modeling intervention
<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Year</th>
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<tbody>
<tr>
<td>Koegel, R. L., Fredeen, R., Kim, S., Danial, J., Rubinstein, D., &amp; Koegel, L.</td>
<td>2012</td>
<td>Implemented socialization opportunities in the form of lunch clubs related to individual interests of adolescent students with autism was effective. Students increased social initiations, responses in continuations in social interactions with non-disabled peers.</td>
</tr>
<tr>
<td>LeBlanc, L. A., Coates, A. M., Daneshvar, S., Charlop-Christy, M. H., Morris, C., &amp; Lancaster, B. M.</td>
<td>2003</td>
<td>Teaching perspective taking skills using video modeling was effective for three students with autism. Using video modeling may be effective method for teaching perspective taking.</td>
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</table>

Delivered via iPad was an effective intervention in teaching students with ASD to check the spelling of words.
<table>
<thead>
<tr>
<th>Authors</th>
<th>Year</th>
<th>Title</th>
<th>Methodology</th>
<th>Components</th>
<th>Description</th>
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<tbody>
<tr>
<td>Morrison, L., Kamps, D., Garcia, J., &amp; Parker, D.</td>
<td>2001</td>
<td>Social and/or Behavioral increase intervals with target initiations and social interactions &amp; monitoring initiating social interactions</td>
<td>Four students with autism were taught to monitor social skills while playing games to increase initiations and social interaction skills. Adult teaching and peer mediation of skills paired with reinforcement for skill use and student monitoring resulted in an increase in measured social skills.</td>
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<tr>
<td>Myles, B., Ferguson, H., &amp; Hagiwara, T.</td>
<td>2007</td>
<td>Curriculum Assistance increase quality of homework recording in English</td>
<td>Adolescent student with Asperger syndrome used a personal digital assistant to record homework assignments. There was a marked increase in recording of homework assignments in the student’s history, English and science classes.</td>
<td></td>
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<tr>
<td>Reichow, B., &amp; Sabornie, E. J.</td>
<td>2009</td>
<td>Social and/or Behavioral increase total initiations Social stories increase acceptable verbal greeting initiations with everyone</td>
<td>Social Stories were successfully utilized to increase acceptable verbal greeting initiations with a student with high functioning autism.</td>
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<tr>
<td>Author(s)</td>
<td>Title/Methodology</td>
<td>Results/Contributions</td>
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<td>Reutebuch, C. K., El Zein, F., Kim, M. K., Weinberg, A. N., &amp; Vaughn, S. (2015)</td>
<td>Social and/or Behavioral decrease challenging behaviors peers intervention; reading comp strategy - activate background knowledge, monitor progress &amp; comprehension</td>
<td>Increase accuracy of responding &amp; decrease challenging behaviors A collaborative strategic reading comprehension intervention was successfully used with three high school students with autism to increase both reading comprehension and social interactions. A decrease in challenging behavior was also noted.</td>
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<td>Scattone, D., Tingstrom, D. H., &amp; Wilczynski, S. M. (2006)</td>
<td>Social and/or Behavioral increase appropriate social interactions Social stories verbal, physical, gestures; initiate and respond to peers</td>
<td>Social stories were successfully used to increase appropriate social interactions of three students with autism during unstructured free time activities.</td>
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<td>Schaefer Whitby, P. J. (2013)</td>
<td>Academic content mastery increase percent correct on word problems (Solve It); cognitive/ meta-cognitive strategies</td>
<td>Math word problems Solve It! Program successfully used to teach seven cognitive strategies and three meta-cognitive strategies to adolescent students in regular education math classes to improve math word problem solving skills.</td>
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</table>
Social and/or Behavioral increase initiations (lunch) SCI-A program; peer initiations; peer proximity initiations lunch  
Two peer mediated interventions (SCI-A) combined with peer initiations/proximity were used to improve school based social competence for three adolescents with high functioning autism.

Academic content mastery increase narrative text comprehension improve comprehension using character event maps comprehension questions; character event map; literary terms list; three column table; table with headings  
Intervention package successfully used with three male adolescents with autism. The intervention scaffolded completion of a character map paired with review of previous session to help participants make predictions about reading and improve narrative reading comprehension.
<table>
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<tr>
<th>Author(s), Year</th>
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<th>RPhi</th>
<th>CI (lower)</th>
<th>CI (upper)</th>
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Reichow, B., & Saborne, E. J. (2009)

<p>| | | | | |</p>
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<td>0.534</td>
<td>0.891</td>
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<td>0.40</td>
<td>0.179</td>
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<td>1.00**</td>
<td>0.874</td>
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<td>1.00**</td>
<td>0.888</td>
<td>1</td>
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<td>56</td>
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<td>1.00**</td>
<td>0.891</td>
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<tr>
<td>57</td>
<td>100.0%</td>
<td>1.00**</td>
<td>0.874</td>
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</tr>
<tr>
<td>58</td>
<td>100.0%</td>
<td>1.00**</td>
<td>0.888</td>
<td>1</td>
</tr>
<tr>
<td>59</td>
<td>100.0%</td>
<td>1.00**</td>
<td>0.89</td>
<td>1</td>
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</tbody>
</table>


96.9% 0.94** 0.795 0.987

60 96.9% 0.94** 0.795 0.987

**Schaefer Whitby, P. J. (2013)**

92.5% 0.81** 0.861 1

61 94.1% 0.84** 0.633 0.943

62 94.7% 0.88** 0.707 0.961

63 88.2% 0.67* 0.441 0.829

**Schmidt, C., & Stichter, J. P. (2012)**

88.5% 0.43 0.139 0.70

64 90% 0.44 0.133 0.724

65 90% 0.44 0.133 0.724

66 90% 0.44 0.133 0.724

67 90% 0.44 0.133 0.724

68 90% 0.44 0.133 0.724

69 90% 0.44 0.133 0.724

70 90.3% 0.45 0.133 0.724
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<th>CI</th>
<th>SE</th>
<th>Effect Size</th>
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<tr>
<td>71</td>
<td>90.3%</td>
<td>0.45</td>
<td>0.133</td>
<td>0.724</td>
</tr>
<tr>
<td>72</td>
<td>90.3%</td>
<td>0.45</td>
<td>0.133</td>
<td>0.724</td>
</tr>
<tr>
<td>73</td>
<td>82.4%</td>
<td>0.39</td>
<td>0.137</td>
<td>0.626</td>
</tr>
<tr>
<td>74</td>
<td>81.3%</td>
<td>0.38</td>
<td>0.133</td>
<td>0.613</td>
</tr>
<tr>
<td>75</td>
<td>81.3%</td>
<td>0.38</td>
<td>0.133</td>
<td>0.613</td>
</tr>
<tr>
<td>76</td>
<td>81.3%</td>
<td>0.38</td>
<td>0.133</td>
<td>0.613</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th></th>
<th>PAND</th>
<th>CI</th>
<th>SE</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>77</td>
<td>100.0%</td>
<td>1.00**</td>
<td>0.889</td>
<td>1</td>
</tr>
<tr>
<td>78</td>
<td>100.0%</td>
<td>1.00**</td>
<td>0.883</td>
<td>1</td>
</tr>
</tbody>
</table>

*Note.* PAND = Percent of All Non-Overlapping data points; CI = Confidence Interval (95%); ** = significant effect; * = moderate effect size; arranged by study meeting inclusion criteria (n=23) in order of first author and comparison graph presentation within each study (k=78); bold calculations indicate effect size estimates for all comparisons in a given study.
<table>
<thead>
<tr>
<th>Year published</th>
<th>Number of studies published</th>
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<tbody>
<tr>
<td>2000</td>
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<td>2003</td>
<td>1</td>
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<tr>
<td>2005</td>
<td>1</td>
</tr>
<tr>
<td>2006</td>
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<tr>
<td>2007</td>
<td>2</td>
</tr>
<tr>
<td>2009</td>
<td>2</td>
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<td>2012</td>
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<td>2013</td>
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<tr>
<td>2014</td>
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<tr>
<td>2015</td>
<td>2</td>
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Table 8

<table>
<thead>
<tr>
<th>Journal</th>
<th>Number of Included Studies</th>
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<tbody>
<tr>
<td>Focus On Autism and Other Developmental Disabilities</td>
<td>6</td>
</tr>
<tr>
<td>Journal of Applied Behavior Analysis</td>
<td>2</td>
</tr>
<tr>
<td>Remedial and Special Education</td>
<td>2</td>
</tr>
<tr>
<td>Research in Autism Spectrum Disorders</td>
<td>2</td>
</tr>
<tr>
<td>Assistive Technology</td>
<td>1</td>
</tr>
<tr>
<td>Behavior Modification</td>
<td>1</td>
</tr>
<tr>
<td>Education and Treatment of Children</td>
<td>1</td>
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<tr>
<td>Education and Training in Developmental Disabilities</td>
<td>1</td>
</tr>
<tr>
<td>Exceptionality</td>
<td>1</td>
</tr>
<tr>
<td>Journal Of Autism and Developmental Disorders</td>
<td>1</td>
</tr>
<tr>
<td>Journal of Positive Behavior Interventions</td>
<td>1</td>
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<tr>
<td>Preventing School Failure</td>
<td>1</td>
</tr>
<tr>
<td>Research and Practice For Persons With Severe Disabilities</td>
<td>1</td>
</tr>
<tr>
<td>Research on Social Work Practice</td>
<td>1</td>
</tr>
<tr>
<td>The Journal of Special Education</td>
<td>1</td>
</tr>
</tbody>
</table>
Table 9  
*Effect Size Comparisons by Research Design*

<table>
<thead>
<tr>
<th>Research Design</th>
<th>Number of Studies (N)</th>
<th>Number of Comparisons (K)</th>
<th>Overall PAND</th>
<th>Overall RPhi</th>
<th>CI (lower)</th>
<th>CI (upper)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple Baseline Across Settings</td>
<td>4</td>
<td>12</td>
<td>91.5%</td>
<td>0.83**</td>
<td>0.658</td>
<td>0.924</td>
</tr>
<tr>
<td>Multiple Baseline Across Behaviors</td>
<td>2</td>
<td>5</td>
<td>90.1%</td>
<td>0.80**</td>
<td>0.626</td>
<td>0.905</td>
</tr>
<tr>
<td>Multiple Baseline Across Participants</td>
<td>12</td>
<td>40</td>
<td>92.2%</td>
<td>0.83**</td>
<td>0.664</td>
<td>0.930</td>
</tr>
<tr>
<td>Withdrawal Design</td>
<td>4</td>
<td>9</td>
<td>84.2%</td>
<td>0.67*</td>
<td>0.424</td>
<td>0.762</td>
</tr>
<tr>
<td>Multiple Treatment</td>
<td>1</td>
<td>15</td>
<td>88.5%</td>
<td>0.43</td>
<td>0.139</td>
<td>0.700</td>
</tr>
</tbody>
</table>

*Note: N = number of studies, K = number of effects, PAND = Percent of all Non-Overlapping Data; Confidence Interval = 95%; ** = significant effect; * = moderate effect*
Table 10

**Effect Size Comparisons by Student Demographics**

<table>
<thead>
<tr>
<th>Student characteristics</th>
<th>(N)</th>
<th>(K)</th>
<th>Overall</th>
<th>Overall</th>
<th>CI</th>
<th>CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>PAND</td>
<td>RPhi</td>
<td>(lower)</td>
<td>(upper)</td>
</tr>
<tr>
<td>All (39)</td>
<td>39</td>
<td>78</td>
<td>90.9%</td>
<td>0.80**</td>
<td>0.615</td>
<td>0.907</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td>---------</td>
<td>---------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>Female</td>
<td>4</td>
<td>10</td>
<td>90%</td>
<td>0.80**</td>
<td>0.623</td>
<td>0.903</td>
</tr>
<tr>
<td>Male</td>
<td>35</td>
<td>68</td>
<td>91.1%</td>
<td>0.80**</td>
<td>0.612</td>
<td>0.909</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
<td>---------</td>
<td>---------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>Hispanic</td>
<td>2</td>
<td>8</td>
<td>91.3%</td>
<td>0.83**</td>
<td>0.658</td>
<td>0.923</td>
</tr>
<tr>
<td>Race Unknown</td>
<td>25</td>
<td>39</td>
<td>92.2%</td>
<td>0.84**</td>
<td>0.673</td>
<td>0.932</td>
</tr>
<tr>
<td>African American</td>
<td>3</td>
<td>6</td>
<td>95.0%</td>
<td>0.77*</td>
<td>0.463</td>
<td>0.927</td>
</tr>
<tr>
<td>Caucasian</td>
<td>8</td>
<td>21</td>
<td>89%</td>
<td>0.71*</td>
<td>0.491</td>
<td>0.854</td>
</tr>
<tr>
<td>Bi-racial</td>
<td>1</td>
<td>4</td>
<td>76.3%</td>
<td>0.51</td>
<td>0.307</td>
<td>0.682</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td>---------</td>
<td>---------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>11 – 12 years old</td>
<td>9</td>
<td>18</td>
<td>97.6%</td>
<td>0.95**</td>
<td>0.807</td>
<td>0.993</td>
</tr>
<tr>
<td>15 - 16 years old</td>
<td>7</td>
<td>15</td>
<td>92.2%</td>
<td>0.82**</td>
<td>0.642</td>
<td>0.925</td>
</tr>
<tr>
<td>17 - 18 years old</td>
<td>6</td>
<td>11</td>
<td>90.1%</td>
<td>0.80**</td>
<td>0.629</td>
<td>0.906</td>
</tr>
<tr>
<td>13 – 14 years old</td>
<td>17</td>
<td>34</td>
<td>88%</td>
<td>0.73**</td>
<td>0.526</td>
<td>0.857</td>
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<tr>
<td><strong>Grade Level</strong></td>
<td></td>
<td></td>
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<td>---------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>6th grade</td>
<td>8</td>
<td>14</td>
<td>92.2%</td>
<td>0.84**</td>
<td>0.674</td>
<td>0.933</td>
</tr>
<tr>
<td>11th – 12th grade</td>
<td>9</td>
<td>14</td>
<td>91.7%</td>
<td>0.83**</td>
<td>0.664</td>
<td>0.925</td>
</tr>
</tbody>
</table>
Student characteristics

<table>
<thead>
<tr>
<th>Grade Level</th>
<th>N</th>
<th>K</th>
<th>Overall PAND</th>
<th>Overall RPhi</th>
<th>CI (lower)</th>
<th>CI (upper)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9th – 10th grade</td>
<td>5</td>
<td>5</td>
<td>91.0%</td>
<td>0.81**</td>
<td>0.633</td>
<td>0.913</td>
</tr>
<tr>
<td>7th – 8th grade</td>
<td>17</td>
<td>34</td>
<td>89.4%</td>
<td>0.74*</td>
<td>0.532</td>
<td>0.871</td>
</tr>
</tbody>
</table>

Intellectual Ability

- Unknown intellectual ability but participation in regular education noted
  - 5 13 92.8% 0.85** 0.692 0.941
- IQ scores reported in the 101-110 range
  - 8 11 94.3% 0.84** 0.642 0.945
- Above average ability and/or diagnosis of Asperger Syndrome
  - 8 9 91.2% 0.82** 0.645 0.918
- IQ scores reported in the 90-100 range
  - 6 9 92.6% 0.80** 0.587 0.917
- Grade level and/or average ability
  - 6 24 86.6% 0.73* 0.545 0.853
- IQ scores reported in the 78-89 range
  - 6 12 89.8% 0.65* 0.395 0.830

Note: n = number of participants; k = number of comparisons; PAND = Percent of All Non-Overlapping data points; Confidence Interval = 95%; ** = significant effect; * = moderate effect size; arranged in order of descending Overall PAND scores
Table 11

*Effect Size Comparisons by Autism Diagnosis Criteria*

<table>
<thead>
<tr>
<th>Autism Diagnosis</th>
<th>(K)</th>
<th>Overall PAND</th>
<th>Overall RPhi</th>
<th>CI (lower)</th>
<th>CI (upper)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autism diagnosis by a school based team</td>
<td>7</td>
<td>100%</td>
<td>1.0**</td>
<td>0.873</td>
<td>1</td>
</tr>
<tr>
<td>multidisciplinary team or school psychologist</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Autism diagnosis via private evaluation or</td>
<td>11</td>
<td>98.3%</td>
<td>0.97**</td>
<td>0.842</td>
<td>0.999</td>
</tr>
<tr>
<td>other independent agency</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Autism diagnosis by a medical doctor via</td>
<td>28</td>
<td>88.5%</td>
<td>0.77*</td>
<td>0.586</td>
<td>0.881</td>
</tr>
<tr>
<td>meeting Diagnostic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Statistical Manual</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Standards (DSM)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unknown diagnosis</td>
<td>32</td>
<td>89%</td>
<td>0.73*</td>
<td>0.520</td>
<td>0.863</td>
</tr>
<tr>
<td>origination</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: n = number of participants; k = number of comparisons; PAND = Percent of All Non-Overlapping data points; Confidence Interval = 95%; ** = significant effect; * = moderate effect size; arranged in order of descending Overall PAND scores*
Table 12

Effect Size Comparisons by Special Education Setting

<table>
<thead>
<tr>
<th>Special education setting</th>
<th>(N)</th>
<th>(K)</th>
<th>Overall</th>
<th>Overall PAND</th>
<th>RPhi</th>
<th>CI (lower)</th>
<th>CI (upper)</th>
</tr>
</thead>
<tbody>
<tr>
<td>social studies class</td>
<td>1</td>
<td>2</td>
<td>97.1%</td>
<td>0.94**</td>
<td></td>
<td>0.809</td>
<td>0.989</td>
</tr>
<tr>
<td>English class</td>
<td>4</td>
<td>11</td>
<td>94.6%</td>
<td>0.89**</td>
<td></td>
<td>0.738</td>
<td>0.964</td>
</tr>
<tr>
<td>math class</td>
<td>1</td>
<td>4</td>
<td>94.4%</td>
<td>0.89**</td>
<td></td>
<td>0.735</td>
<td>0.962</td>
</tr>
<tr>
<td>science class</td>
<td>1</td>
<td>1</td>
<td>94.1%</td>
<td>0.88**</td>
<td></td>
<td>0.729</td>
<td>0.959</td>
</tr>
<tr>
<td>Unknown</td>
<td>20</td>
<td>40</td>
<td>92.7%</td>
<td>0.85**</td>
<td></td>
<td>0.677</td>
<td>0.937</td>
</tr>
<tr>
<td>Curriculum assistance class</td>
<td>1</td>
<td>7</td>
<td>86.2%</td>
<td>0.72*</td>
<td></td>
<td>0.528</td>
<td>0.844</td>
</tr>
<tr>
<td>Resource class</td>
<td>4</td>
<td>19</td>
<td>90.3%</td>
<td>0.64</td>
<td></td>
<td>0.372</td>
<td>0.830</td>
</tr>
<tr>
<td>Most of the day</td>
<td>2</td>
<td>2</td>
<td>80.0%</td>
<td>0.60*</td>
<td></td>
<td>0.398</td>
<td>0.749</td>
</tr>
<tr>
<td>Part of the day</td>
<td>3</td>
<td>3</td>
<td>68.8%</td>
<td>0.35</td>
<td></td>
<td>0.137</td>
<td>0.541</td>
</tr>
</tbody>
</table>

Note: n = number of participants; k = number of comparisons; PAND = Percent of All Non-Overlapping data points; Confidence Interval = 95%; ** = significant effect; * = moderate effect size; arranged in order of descending Overall PAND scores
<table>
<thead>
<tr>
<th>Service Delivery Intensity</th>
<th>(N)</th>
<th>(K)</th>
<th>Overall PAND</th>
<th>Overall RPhi</th>
<th>CI (lower)</th>
<th>CI (upper)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Regular education services described</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Four or five regular education classes</td>
<td>2</td>
<td>2</td>
<td>97%</td>
<td>0.94**</td>
<td>0.803</td>
<td>0.989</td>
</tr>
<tr>
<td>Two regular education classes</td>
<td>8</td>
<td>7</td>
<td>97%</td>
<td>0.94**</td>
<td>0.793</td>
<td>0.988</td>
</tr>
<tr>
<td>Number of classes unknown</td>
<td>10</td>
<td>23</td>
<td>92%</td>
<td>0.83**</td>
<td>0.660</td>
<td>0.931</td>
</tr>
<tr>
<td>Most of the day in regular education</td>
<td>6</td>
<td>41</td>
<td>90.1%</td>
<td>0.77*</td>
<td>0.582</td>
<td>0.892</td>
</tr>
<tr>
<td>One regular education class</td>
<td>2</td>
<td>2</td>
<td>87.5%</td>
<td>0.74*</td>
<td>0.552</td>
<td>0.861</td>
</tr>
<tr>
<td>Three regular education classes</td>
<td>2</td>
<td>3</td>
<td>80%</td>
<td>0.60*</td>
<td>0.40</td>
<td>0.75</td>
</tr>
<tr>
<td><strong>Special education services provided</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Two special education classes</td>
<td>1</td>
<td>9</td>
<td>94.8%</td>
<td>0.89**</td>
<td>0.74</td>
<td>0.97</td>
</tr>
<tr>
<td>Three or four special education classes</td>
<td>2</td>
<td>2</td>
<td>94.1%</td>
<td>0.88**</td>
<td>0.729</td>
<td>0.959</td>
</tr>
<tr>
<td>Number of classes unknown</td>
<td>30</td>
<td>37</td>
<td>92.7%</td>
<td>0.85**</td>
<td>0.677</td>
<td>0.937</td>
</tr>
<tr>
<td>One special education class</td>
<td>30</td>
<td></td>
<td>87.6%</td>
<td>0.69*</td>
<td>0.470</td>
<td>0.834</td>
</tr>
<tr>
<td>Most of the day</td>
<td>1</td>
<td>2</td>
<td>80.0%</td>
<td>0.60*</td>
<td>0.398</td>
<td>0.749</td>
</tr>
<tr>
<td><strong>Paraprofessional Assistance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher Assistant Support</td>
<td>4</td>
<td>16</td>
<td>88.8%</td>
<td>0.77*</td>
<td>0.587</td>
<td>0.883</td>
</tr>
</tbody>
</table>

Note: n = number of participants; k = number of comparisons; PAND = Percent of All Non-Overlapping data points; Confidence Interval = 95%; ** = significant effect; * = moderate effect size; arranged in order of descending Overall PAND scores
<table>
<thead>
<tr>
<th>Regular education setting</th>
<th>(N)</th>
<th>(K)</th>
<th>Overall PAND</th>
<th>Overall RPhi</th>
<th>CI (lower)</th>
<th>CI (upper)</th>
</tr>
</thead>
<tbody>
<tr>
<td>elective classes</td>
<td>5</td>
<td>3</td>
<td>100%</td>
<td>1.0**</td>
<td>0.883</td>
<td>1.0</td>
</tr>
<tr>
<td>math class</td>
<td>10</td>
<td>5</td>
<td>93.3%</td>
<td>0.87**</td>
<td>0.709</td>
<td>0.949</td>
</tr>
<tr>
<td>mainstream or inclusion classes</td>
<td>4</td>
<td>12</td>
<td>93.3%</td>
<td>0.86**</td>
<td>0.681</td>
<td>0.936</td>
</tr>
<tr>
<td>unknown regular education class</td>
<td>10</td>
<td>19</td>
<td>91.6%</td>
<td>0.81**</td>
<td>0.630</td>
<td>0.917</td>
</tr>
<tr>
<td>English class</td>
<td>8</td>
<td>9</td>
<td>84.9%</td>
<td>0.78*</td>
<td>0.607</td>
<td>0.893</td>
</tr>
<tr>
<td>science class</td>
<td>9</td>
<td>6</td>
<td>87.3%</td>
<td>0.75*</td>
<td>0.566</td>
<td>0.866</td>
</tr>
<tr>
<td>social studies class</td>
<td>7</td>
<td>7</td>
<td>86.8%</td>
<td>0.74*</td>
<td>0.553</td>
<td>0.857</td>
</tr>
<tr>
<td>most or all of the day</td>
<td>6</td>
<td>33</td>
<td>89.3%</td>
<td>0.72*</td>
<td>0.511</td>
<td>0.864</td>
</tr>
</tbody>
</table>

*Note: n = number of participants; k = number of comparisons; PAND = Percent of All Non-Overlapping data points; Confidence Interval = 95%; ** = significant effect; * = moderate effect size; arranged in order of descending Overall PAND scores*
Table 15

**Effect Size Comparisons by Intervention Category**

<table>
<thead>
<tr>
<th>Intervention Outcome Category</th>
<th>(N)</th>
<th>(K)</th>
<th>(I)</th>
<th>(R)</th>
<th>(O)</th>
<th>Overall</th>
<th>Overall PAND</th>
<th>RPhi</th>
<th>CI (lower)</th>
<th>CI (upper)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social and/or behavioral</td>
<td>12</td>
<td>46</td>
<td>25</td>
<td>12</td>
<td>36</td>
<td>91.6%</td>
<td>0.81**</td>
<td>0.627</td>
<td>0.917</td>
<td></td>
</tr>
<tr>
<td>Interventions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academic content</td>
<td>6</td>
<td>15</td>
<td>10</td>
<td>5</td>
<td>13</td>
<td>88.7%</td>
<td>0.76*</td>
<td>0.576</td>
<td>0.878</td>
<td></td>
</tr>
<tr>
<td>interventions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Curriculum assistance</td>
<td>6</td>
<td>17</td>
<td>8</td>
<td>6</td>
<td>8</td>
<td>81.6%</td>
<td>0.59*</td>
<td>0.382</td>
<td>0.743</td>
<td></td>
</tr>
<tr>
<td>interventions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: n = number of interventions; k = number of comparisons; i = number of students included in this analysis; r = number of research teams conducting studies in this category; o = overall number of original participants in study; PAND = Percent of All Non-Overlapping data points; Confidence Interval = 95%; * = moderate effect size; arranged in order of descending Overall PAND scores*
<table>
<thead>
<tr>
<th>Outcome Category</th>
<th>(n)</th>
<th>(k)</th>
<th>Overall PAND</th>
<th>Overall RPhi</th>
<th>CI (lower)</th>
<th>CI (upper)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase social interaction</td>
<td>9</td>
<td>40</td>
<td>93.8%</td>
<td>0.86**</td>
<td>0.680</td>
<td>0.948</td>
</tr>
<tr>
<td>Increase academic skill mastery</td>
<td>11</td>
<td>33</td>
<td>88.6%</td>
<td>0.76*</td>
<td>0.572</td>
<td>0.877</td>
</tr>
<tr>
<td>Decrease inappropriate behavior</td>
<td>3</td>
<td>7</td>
<td>81.8%</td>
<td>0.63*</td>
<td>0.434</td>
<td>0.776</td>
</tr>
</tbody>
</table>

*Note: n = number of studies; k = number of comparisons; PAND = Percent of All Non-Overlapping data points; Confidence Interval = 95%; * = moderate effect size; arranged in order of descending Overall PAND scores*
Table 17

*Effect Size Comparisons by Independent Variable Category*

<table>
<thead>
<tr>
<th>Independent Variable Category</th>
<th>(N)</th>
<th>(K)</th>
<th>Overall</th>
<th>PAND</th>
<th>RPhi</th>
<th>CI (lower)</th>
<th>CI (upper)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multicomponent adult mediated intervention</td>
<td>6</td>
<td>11</td>
<td>97.2%</td>
<td>97.2%</td>
<td>0.94**</td>
<td>0.791</td>
<td>0.99</td>
</tr>
<tr>
<td>Social Stories</td>
<td>2</td>
<td>3</td>
<td>96.1%</td>
<td>0.91**</td>
<td>0.734</td>
<td>0.975</td>
<td></td>
</tr>
<tr>
<td>Peer mediated interventions</td>
<td>6</td>
<td>40</td>
<td>90.8%</td>
<td>0.79*</td>
<td>0.595</td>
<td>0.901</td>
<td></td>
</tr>
<tr>
<td>Technology component within</td>
<td>5</td>
<td>17</td>
<td>88.7%</td>
<td>0.77*</td>
<td>0.590</td>
<td>0.884</td>
<td></td>
</tr>
<tr>
<td>Self-monitoring interventions</td>
<td>4</td>
<td>9</td>
<td>85.9%</td>
<td>0.71*</td>
<td>0.512</td>
<td>0.835</td>
<td></td>
</tr>
</tbody>
</table>

Note: n = number of studies; k = number of comparisons; PAND = Percent of All Non-Overlapping data points; Confidence Interval = 95%; ** = significant effect; * = moderate effect size; arranged in order of descending Overall PAND scores
Table 18

*Effect Size Comparisons by Dependent Variable Category*

<table>
<thead>
<tr>
<th>Intervention outcome category</th>
<th>(N)</th>
<th>(K)</th>
<th>Overall</th>
<th>Overall PAND</th>
<th>RPhi</th>
<th>CI (lower)</th>
<th>CI (upper)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social behavior in non-academic settings</td>
<td>9</td>
<td>40</td>
<td>93.3%</td>
<td>0.84**</td>
<td>0.663</td>
<td>0.939</td>
<td></td>
</tr>
<tr>
<td>Organization and study skills</td>
<td>3</td>
<td>8</td>
<td>88.60%</td>
<td>0.77*</td>
<td>0.583</td>
<td>0.88</td>
<td></td>
</tr>
<tr>
<td>Specific content mastery skills</td>
<td>4</td>
<td>13</td>
<td>87.90%</td>
<td>0.75*</td>
<td>0.559</td>
<td>0.886</td>
<td></td>
</tr>
<tr>
<td>Inappropriate behavior</td>
<td>1</td>
<td>3</td>
<td>87.50%</td>
<td>0.75*</td>
<td>0.562</td>
<td>0.865</td>
<td></td>
</tr>
<tr>
<td>On-task behaviors</td>
<td>4</td>
<td>9</td>
<td>84.5%</td>
<td>0.69*</td>
<td>0.498</td>
<td>0.820</td>
<td></td>
</tr>
<tr>
<td>Social engagement in academic settings</td>
<td>1</td>
<td>5</td>
<td>85.9%</td>
<td>0.51*</td>
<td>0.249</td>
<td>0.723</td>
<td></td>
</tr>
</tbody>
</table>

*Note: n = number of participants; k = number of comparisons; PAND = Percent of All Non-Overlapping data points; Confidence Interval = 95%; * = moderate effect size; arranged in order of descending Overall PAND scores*
Table 19

**Included Study Quality of Evidence**

<table>
<thead>
<tr>
<th>Evidence of meeting WWC standards</th>
<th>Evidence of meeting WWC standards with reservations</th>
<th>Insufficient evidence of meeting WWC standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAND = 88.1%</td>
<td>PAND = 90.1</td>
<td>PAND = 91.2%</td>
</tr>
<tr>
<td>RPhi = 0.76</td>
<td>RPhi = 0.78</td>
<td>RPhi = 0.80</td>
</tr>
<tr>
<td>CI = (0.577-0.874)</td>
<td>CI = (0.594-0.896)</td>
<td>CI = (0.612-0.909)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Schaefer Whitby, P. J., 2013</td>
</tr>
</tbody>
</table>
Table 20

*Effect Size Comparisons by Intervention Agent*

<table>
<thead>
<tr>
<th>Intervention Agent</th>
<th>(N)</th>
<th>(K)</th>
<th>Overall</th>
<th>Overall PAND</th>
<th>RPhi</th>
<th>CI (lower)</th>
<th>CI (upper)</th>
</tr>
</thead>
<tbody>
<tr>
<td>School staff</td>
<td>5</td>
<td>16</td>
<td>94.4%</td>
<td>0.89**</td>
<td></td>
<td>0.731</td>
<td>0.0961</td>
</tr>
<tr>
<td>Role of intervention agents unclear</td>
<td>7</td>
<td>34</td>
<td>92.1%</td>
<td>0.81**</td>
<td></td>
<td>0.621</td>
<td>0.919</td>
</tr>
<tr>
<td>Researchers work collaboratively with school staff</td>
<td>11</td>
<td>28</td>
<td>87.3%</td>
<td>0.73*</td>
<td></td>
<td>0.538</td>
<td>0.855</td>
</tr>
<tr>
<td>Regular education peers involved in implementing intervention</td>
<td>8</td>
<td>40</td>
<td>77.9%</td>
<td>0.49</td>
<td></td>
<td>0.595</td>
<td>0.901</td>
</tr>
</tbody>
</table>

*Note: n = number of participants; k = number of comparisons; PAND = Percent of All Non-Overlapping data points; Confidence Interval = 95%; ** = significant effect; * = moderate effect size; arranged in order of descending Overall PAND scores*
Table 21

**Effect Size Comparisons by Intervention Setting**

<table>
<thead>
<tr>
<th>Intervention Setting</th>
<th>(N)</th>
<th>(K)</th>
<th>Overall</th>
<th>Overall PAND</th>
<th>RPhi</th>
<th>CI (lower)</th>
<th>CI (upper)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cafeteria and/or hallway</td>
<td>6</td>
<td>21</td>
<td>91.3%</td>
<td>0.79</td>
<td>0.596</td>
<td>0.79</td>
<td>0.907</td>
</tr>
<tr>
<td>Unknown</td>
<td>9</td>
<td>24</td>
<td>89%</td>
<td>0.77*</td>
<td>0.621</td>
<td>0.67</td>
<td>0.919</td>
</tr>
<tr>
<td>Special education classroom</td>
<td>9</td>
<td>17</td>
<td>87.4%</td>
<td>0.70*</td>
<td>0.496</td>
<td>0.45</td>
<td>0.841</td>
</tr>
<tr>
<td>Regular education classroom</td>
<td>19</td>
<td>25</td>
<td>87.3%</td>
<td>0.72*</td>
<td>0.518</td>
<td>0.49</td>
<td>0.849</td>
</tr>
</tbody>
</table>

*Note: n = number of settings; k = number of comparisons; PAND = Percent of All Non-Overlapping data points; Confidence Interval = 95%; * = moderate effect size; arranged in order of descending Overall PAND scores*
## Table 22

**Effect Size Comparisons by Intervention Length**

<table>
<thead>
<tr>
<th>Intervention length</th>
<th>(K)</th>
<th>Overall PAND</th>
<th>Overall RPhi</th>
<th>CI (lower)</th>
<th>CI (upper)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention data collection between 1-7 days</td>
<td>12</td>
<td>93.4%</td>
<td>0.86**</td>
<td>0.703</td>
<td>0.948</td>
</tr>
<tr>
<td>Intervention data collection for 20 or more days</td>
<td>24</td>
<td>92%</td>
<td>0.79*</td>
<td>0.585</td>
<td>0.910</td>
</tr>
<tr>
<td>Intervention data collection between 8-14 days</td>
<td>25</td>
<td>89.5%</td>
<td>0.78*</td>
<td>0.594</td>
<td>0.891</td>
</tr>
<tr>
<td>Intervention data collection between 15-20 days</td>
<td>18</td>
<td>89.2%</td>
<td>0.78*</td>
<td>0.596</td>
<td>0.889</td>
</tr>
</tbody>
</table>

*Note: k = number of comparisons; PAND = Percent of All Non-Overlapping data points; Confidence Interval = 95%; ** = significant effect; * = moderate effect size; arranged in order of descending Overall PAND scores*
Appendix B

Excluded Studies

Study Not Single Case Research Design (n=861)

Agyapong, V., Migone, M., & Marckey, B. (2009)
Aronson, S. (2009)
Arunothong, W., & Waewsawangwong, S. (2012)
August, G. J. (1987)
Bailey, A. (2014)
Baines, A. D. (2012)
Ball, J., & Lewis, M. (2014)
Ball, S. (2014)
Barron, I. G., & Topping, K. J. (2011)
Beardslee, W., Bryer, F., & Kliewe, H. (2014)
Beecham, J. (2014)
Benrazavi, R., Teimouri, M., & Griffiths, M. D. (2015)
Biederman, J., Ball, S. W., Monuteau1, M. C., Surman, C. B., Johnson, J. L., & Zeitlin, S. (2007)
Bitsika, V., & Sharpley, C. F. (2014). Understanding,
Booker, K. W., & Starling, L. (2011)
Bornman, J. (2005)
Bottema-Beutel, K., & Li, Z. (2015)
Bottema-Beutel, K., & Smith, N. (2013)
Bourreau, Y., Rou1, S., Gomot, M., Bonnet-Brilhault, F., & Barthélémy, C. (2009)
Bradley-Klug, K., & Grier, J. E. (2000)
Brand Flu, R. L. (2011)
Brown, L. (2009)
Burke, G. M. (1990)
Burke, J. D., Loeber, R., & Lahey, B. B. (2001)
Campbell, J. M., & Barger, B. D. (2011)
Campbell, J. M., Morton, J. F., Rouston, K., & Barger, B. D. (2011)
Carr, T., & Lord, C. (2013)
Cavalari, R. S., & Romanczyk, R. G. (2012)
Chae, J. (2014)
Charak, D. A., & Stella, J. L. (2001)
Charlson, E., Strong, M., & Gold, R. (1992)
Charman, T., & Baron-Cohen, S. (1997)
Clark, P. (2008)
Coates, J. (2015)
Coleman, R., Piek, J. P., & Livesey, D. J. (2001)
Columna, L., Cook, A., Foley, J. T., & Bailey, J. (2014)
Conner, C. M., Maddo1, B. B., & White, S. W. (2013)
Connor, D. J. (2013)
Cortese, S. (2013)
Datta, S. S. (2009)
Daviss, W. B., & Diler, R. S. (2014)
Dean, K. (2010)
Deane, H., & Young, S. (2014)
Decuir, A. (1991)
Dillon, L. (2008)
Dillon, K. P., & Bushman, B. J. (2015)
Dorrell, J., & Katz, J. (2013)
Drucker, J. (2009)
Dua, V. (2008)
Dubow, E. F., Bo1er, P., Huesmann, L. R., Landau, S., Dvir, S., Shikaki, K., & Ginges, J. (2012)
Durand, V. M., & Kern, L. (2014)
Durand, V., & Koegel, R. L. (2011)
Early, B. P. (1995)
Egeland, J., Aarlien, A. K., & Saunes, B. (2013)
El-Ghoroury, N., & Krackow, E. (2011)
Ellis, B., & Nigg, J. (2009)
Emerson, A., & Dearden, J. (2013)
Emily, G., & Grace, I. (2015)
Engelhardt, C. R., & Mazurek, M. O. (2014)
Fitzgerald, P. B. (2014)
Evans, S. W., Green, A. L., & Serpell, Z. N. (2005)
Fabian, A. E. (1972)
Fagbemissi, R. C., Lie, R., & Leeuwis, C. (2009)
Gilmore, L. (2014)
Glass, K., Flory, K., & Hankin, B. L. (2012)
Gobbo, K., & Shmulsky, S. (2014)
Goldstein, B. I. (2012)
Gomez, R. (2012)
Goodson, B., & Williamson, E. (2012)
Görker, I., & Tüzün, Ü. (2005)
He, A. S. (2015)
Heaton, P. (2012)
Henderson, L. M., Clarke, P. J., & Snowling, M. J. (2014)
Hobson, R. (1986)
Holmberg, K., & Bölte, S. (2014)
Hong, D. S. (2014)
Hoppe, S. E. (2005)
Howlin, P. (2010)
Howlin, P. (2011)
Hughes, C. (2011)
Hume, K. (2014)
Humphrey, N., & Ralph, S. (2010)
Humphrey, N., & Symes, W. (2011)
Hus, Y. (2014)
Hyman, M. (2009)
Hyo Jung, L. (2011)
Idemudia, E. S. (2014)
Inada, N., Koyama, T., Inokuchi, E., Kuroda, M., & Kamio, Y. (2011)
Johnson, A. H. (2014)
Kadar, M., McDonald, R., & Lentin, P. (2015)
Kalali, A. H. (2010)
Kam, J., & Yang, S. (2014)
Karabekiroglu, K., & Aman, M. G. (2009)
Karge, B. D., & Lasky, B. (2009)
Kasari, C. (2014)
Kazancioglu, F. (2012)
Kealy, T. (2012)
Kelly, A. (2008)
Kholmogorova, A. B., & Smirnova, N. S. (2009)
Kimhi, Y.
King, D., Dockrell, J. E., & Stuart, M. (2013)
Kishore, M. T., & Basu, A. (2014)
Koller, R. (2000)
Konior, J. (1993)
Krahé, B. (2014)
Kupperman, P. (1997)
Kwok, S. Y. C. L., Chai, W., & He, I. (2013)
Myles, B., & Simpson, R. L. (2001)
Nepo, K. G. (2010)
Ness, B. M. (2013)
Nielsen, C. M. B. (2011)
Oliver, C., Berg, K., Moss, J., Arron, K., & Burbidge, C. (2011)
Owley, T., McMahan, W., Cook, E. H., Laulhere, T., South, M., Mays, L., & ... Filipek, P. A. (2001)
Pellicano, L. (2007)
Peterson, C. C., & Slaughter, V. (2009)
Schreiber, C. (2011)
Seale, J. (2013)
Senner, J. E. (2011)
Shapiro, T., Sherman, M., Calamari, G., & Koch, D. (1987)
Shtayermman, O. (2011)
Shuttleworth, J. (1999)
Stahmer, A. C. (2007)
Stahmer, A. C., Brookman-Frazee, L., Lee, E., Searcy, K., & Reed, S. (2011)
Stahmer, A. C., Suhrheinrich, J., Reed, S., & Schreibman, L. (2012)
Stahmer, A. C., Suhrheinrich, J., Reed, S., Bolduc, C., & Schreibman, L. (2010)
Stuart-Smith, S. (1994)
Suhrheinrich, J. (2015)
Sutherland, S., & Stroot, S. A. (2009)
Szatmari, P. (2012)
Taneja Johansson, S. (2014)
Tellegen, C. L., & Sanders, M. R. (2014)
Thompson, E. (2013)
Thomsen, P. H. (2010)
Timimi, S. (2014)
Tissot, C. (2009)
Trillingsgaard, A., & Sørensen, E. U. (1994)
Varley, C. K. (1985)
Vaughan, C. A. (2011)
Volker, M. A. (2012)
Webster, A., Feiler, A., & Webster, V. (2003)
Wilczynski, S. M. (2013)
Williams, K. (1995)
Williams, K. (2001)
Williamson, E. (2009)
Wills, N. (2007)
Zablotsky, B., Bradshaw, C., & Stuart, E. (2013)
Zuddas, A. (2013)

**Participant(s) in the study were not diagnosed with autism (n=807)**

Achenbach, T. M. (2007)
Adams, H. L., & Williams, L. R. (2014)
Keightley, M. (2014)
Alqahtani, M. M. (2010)
Al-Sharbatly, M. (2012)
Anderson, M. G. (1992)
Arnold, L. (1996)
Atome1etine for ADHD symptoms in youth with autism. (2012)
Barnes, S. J. (1993)
Basáñez, T., Warren, M., Crano, W., & Unger, J. (2014)
Biederman, J. (1991)
Bu, I., Tian, I., & Liu, M. (2010)
Calcagnoli, F., Boer, S., Althaus, M., Boer, J., & Koolhaas, J. (2013)
Cantwell, D. P. (1993)
Carpenter, J. C. (1976)
Chabot, R. J., di Michele, F., Prichep, L., & John, E. (2001)
Cipani, E. (1988)
Coghill, D., & Seth, S. (2011)
Colbert, E. G., & Koegler, R. R. (1961)
Cooper, M., & Rajyaguru, P. (2013)
Fauconnier, J. (2015)
de Mello, C., Rossi, A., Cardoso, T., Rivero, T., de Moura, L., Nogueira, R., & ... Muszkat, M. (2013.)
DeBono, T., Hosseini, A., Cairo, C., Ghelani, K., Tannock, R., & Toplak, M. E. (2012)
Dockrell, J. E., Messer, D., George, R., & Wilson, G. (1998)
Durán, E. (1985)
Evans, S. W. (1994)
Evans, S. W., & Youngstrom, E. (2006)
Evans, S. W., Pelham, W., & Grudberg, M. V. (1994)
Evans, S. W., Schultz, B. K., White, L., Brady, C., Sibley, M. H., & Van Eck, K. (2009)
Evans, S. W., Sibley, M., & Serpell, Z. N. (2009)
Fabiano, G. A. (2014)
Ferrin, M., & Vance, A. (2014)
García, T., Rodríguez, C., González-Castro, P., Álvarez, D., Cueli, M., & González-Pienda, J. (2013)
Hartas, D., & Donahue, M. L. (1997)
Luiselli, J. K., Kane, A., Treml, T., & Young, N. (2000)
Mittal, V. A. (2013)
Manor-Binyamini, I. (2012)
Mark, G., & Smith, A. P. (2012)
Markham, C., & Dean, T. (2006)
Martens, B. K., & Houk, J. L. (1989)
Martin, C. N., & Konopka, L. M. (2011)
Morales, H. O., & de, l. R. (2011)
Nagai, K., Natori, T., Nishino, T., & Kodaira, F. (2008)
National institutes of health consensus development conference statement: Diagnosis and treatment of attention-deficit/hyperactivity disorder. (2000)
Nigg, J. T., & Holton, K. (2014)
Nobile, M., Rusconi, M., Bellina, M., Marino, C., Giorda, R., Carlet, O., ... Battaglia, M. (2010)
Noceilla, G., Romano, D., & Stefani, G. (2014)
Nock, M. K. (2009)
Norbury, C. F. (2014)
Nutt, D., Gispen-de Wied, C. C., Arango, C., Keefe, R. E., Penadés, R., Murphy, D. G., & ... Sahakian, B. (2013)
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Olley, B. O. (2007)
Palmes, T., & Millington, P. (2012)
Palombo, J. (1996)
Park, S., Na, E., & Kim, E. (2014)
Pellecchia, M., Connell, J. E., Eisenhart, D., Kane, M., Schoener, C., Turkel, K., & ... Mandell, D. S. (2011)
Perfitt, R. (2013)
Perry, R. (2001)
Petrill, S. (2009)
Piazza, C. C., & And, O. (1996)
Pijl, S. J. (2012)
Piper, B. J., Gray, H. M., Raber, J., & Birkett, M. A. (2014)
Poon, K., & Ho, C. S. (2014)
Prieler, M., & Choi, J. (2014)
Quay, H. C., Routh, D. K., & Shapiro, S. K. (1987)
Lanovaz, M. J. (2013)
Reeves, L. (2014)
Reher, M. (2010)
Reid, R., & Ron Nelson, J. (2002)
Jung, T. M. (2005)
Remine, M. D., & Brown, P. M. (2010)
Renati, R., Berro1e, C., & Zanetti, M. A. (2012)
Rende, R. (2014)
Reyna, V. F., & Brainerd, C. J. (2011)
Rickson, D. J. (2006)
Ridosh, M., Braun, P., Rou1, G., Bellin, M., & Sawin, K. (2011)
Rinsky, J. R., & Hinshaw, S. P. (2011)
Rogers, S. J. (1991)
Schumann, L., Craig, W., & Rosu, A. (2014)
Schwannauer, M., Noble, A., & Fraser, G. (2011)
Scott, S., Briskman, J., & O’Connor, T. G. (2014)
Séguin, J. R., & Leckma, n. F. (2013)
Sellman, E. (2009)
Sessa, B., & Sutherland, H. (2013)
Sigafoos, J., & Drasgow, E. (2001)
Silberg, J. L., & Bulik, C. M. (2005)
Skarakis-Doyle, E. (2005)
Slattery, T., & Meyers, S. (2014)
Solmaz, M., Belli, H., & Saygili, S. (2011)
Sonuga-Barke, E., Koerting, J., Smith, E., McCann, D. C., & Thompson, M. (2011)
Spensley, S. (1985)
Sprung, M. (2010)
Stahr, B., Cushing, D., Lane, K., & Foil, J. (2006)
Stanley, F. (2001)
Stanton, J. (2005)
Steele, M. M. (2007)
Stergiakouli, E., & Thapar, A. (2010)
Stickles, J. L., Schilmoeller, G. L., & Schilmoeller, K. J. (2002)
Stone, E. (1992)
Ströhle, A. (2011)
Stringaris, A. (2011)
Strully, J. L. (2013)
Tan, T. I. (2014)
Taylor, E., Sergeant, J., Doepfner, M., Gunning, B., Overmeyer, S., Möbius, H. -., & Eisert, H. -.
(1998)
Temple, C. M. (2006)
Terry, J. (2009)
Thapar, A., & Lewis, G. (2009)
Thomaes, S., Bushman, B. J., de Castro, B. O., & Stegge, H. (2009)
Thompson, C., Russell-Mayhew, S., & Saraceni, R. (2012)
Thompson, S. J. (2005)
(2004)
Tran, O. K., & Furlong, M. J. (2004)
Trechak, A. (2011)
Triantafyllou, E. (2007)
Trott, G. (2006)
Tryon, W. W. (1993)
Tsiori, I., & Greer, R. D. (2007)
Turkstra, L. S. (2005)
Turnbull, A., Zuna, N., Hong, J. Y., Hu, 1., Kyzar, K., Obremski, S., ... Stowe, M. (2010)
Úbeda, F., & Gardner, A. (2010)
van Rijn, S., & Swaab, H. (2011)
van, d. O., Prins, P. J. M., Oosterlaan, J., & Emmelkamp, P. M. G. (2008)
Vernon, L., Barber, B. L., & Modecki, K. L. (2015)
Vigo, R., Evans, S. W., & Owens, J. S. (2015)
Villasenor, R., & Vargas-Colon, K. (2012)
Volkow, N. D. (2012)
Waid, J. (2014)
Wallander, J. L. (1988)
Wankoff, L. S. (2011)
Wickenden, M. (2011)
Wilk, S., Cordier, R., Bundy, A., Docking, K., & Munro, N. (2011)
Wilkinson, B. (2011)
Williams, B. E. (1987)
Williams, J., & Dayan, P. (2005)
Wills, K. (2005)
Windle, M., & Davies, P. T. (1999)
Wong, W., Fletcher, D. F., Traini, D., Chan, H., & Young, P. M. (2012)
Wray, R. J. (2006)
Xiao, L., Yin, Y., Sun, W., Zhang, F., & Li, Z. (2013)
Yilmaz, H. (2011)
Yirmiya, N. (2009)
Yordanova, J., Kolev, V., Albrecht, B., Uebel, H., Banaschewski, T., & Rothenberger, A. (2011)
Young, S., & Amarasinghe, J. M. (2010)
Young, S., Chadwick, O., Heptinstall, E., Taylor, E., & Sonuga-Barke, E. (2005)
Young, T. J., Manthorp, C., Howells, D., & Tullo, E. (2011)
Zehnder, D., Meuli, M., & Landolt, M. A. (2010)

**Medical Intervention or Treatment (n=432)**

Alter, M. D., Kharkar, R., Ramsey, K. E., Craig, D. W., Melmed, R. D., Grebe, T. A., & ... Stephan, D. A. (2011)
Scahill, L. (2010)
Amo1apine used to treat two children with autistic disorder. (2003)
Andrasik, F. (2007)
Androuotos, C. (2012)
Anjum, N., & Malik, F. (2010)
Arnold, L. E., Aman, M. G., & Li, 1. 1. (2012)
Williams, C. (2005)
Mendoza, S. P. (2013)
Baudouin, S. J. (2014)
Benson, P. R. (2014)
Biederman, J., & Spencer, T. J. (2000)
Blacher, J., Baker, B. L., & Kaladjian, A. (2013)
Pelphrey, K. A. (2011)
Brand, M., Laier, C., & Young, K. S. (2014)
Briegel, W., Schneider, M., & Schwab, K. O. (2008)
Bryant, R. A. (2007)
Campbell, M., & Armenteros, J. L. (1997)
Campbell, M., & Schopler, E. (1996)
Canitano, R. (2013)
Canitano, R., & Scandurra, V. (2008)
Castellanos, F. I., & Dickstein, S. (2005)
Cavalarí, Rachel N. S., Melanie DuBard, and James K. Luiselli, 2014
Chiu, S. (2008)
Chnstakou, A., Murphy, C. M., Chantiuke, K., Cubillo, A. I., Smith, A. B., Giampietro, V., . . . Rubia, K. (2013)
Cocchi, R. (1990)
Cooper, M., Martin, J., Langley, K., Hamshere, M., & Thapar, A. (2014)
Cortese, S. (2013)
Cragun, D., Ata, R. N., DeBate, R. D., & Thompson, J. K. (2013)
Crino, P. (2013)
Darnell, J. C., Van Driesche, S. J., Zhang, C., Hung, K., Mele, A., Fraser, C. E., & ... Darnell, R. B. (2011)
DeVylder, J. E., Muchomba, F. M., Gill, K. E., Ben-David, S., Walder, D. J., Malaspina, D., & Corcoran, C. M. (2014)
DiClemente, R. J. (1991)
Dodds, E. D., Tassone, F., Hagerman, P. J., & Lebrilla, C. B. (2009)
Anagnostou, E. (2013)
Duan, G., Yao, M., Ma, Y., & Zhang, W. (2014)
Eilam-Stock, T., Hu, P., Cao, M., Gu, 1., Van Dam, N. T., Anagnostou, E., & ... Fan, J. (2014)
Endo, A. (2008)
Erickson, C., Veenstra-Vanderweele, J., Melmed, R., McCracken, J., Ginsberg, L., Sikich, L., & ... King, B. (2014)
Evans, S. W., Schultz, B. K., & DeMars, C. E. (2014)
Ferguson, C., Muñoz, M., Garza, A., & Galindo, M. (2014)
Fisch, G. S., Simensen, R. J., & Schroer, R. J. (2002)
Gadow, K. D. (2012)
Hatchwell, E. (2010)
Haq, A. U., & Ghaziuddin, N. (2014)
Kim, Y., Shin, M., Kim, J., Yoo, H., Cho, S., & Kim, B. (2009)
Klein-Tasman, B., Li-Barber, K., & Magargee, E. T. (2011)
Lake, J. K., Balogh, R., & Lunsky, Y. (2012)
Langevin, R., & Ramdé, J. (2012)
Laviola, G., Ognibene, E., Romano, E., Adriani, W., & Keller, F. (2009)
Anderson, J. S. (2013)
O’Hare, A. (2009)
O’Hearn, K., Schroer, E., Minshew, N., & Luna, B. (2010)
Odom, S. L., Col, A. W., & Brock, M. E. (2013)
Osunsanmi, S. E. (2010)
Pan, C. (2014)
Pan, Chien-Yu, (2014)
Pfeiffer, B., Kinnealey, M., Reed, C., & Herzberg, G. (2005)
Pierce, K. (2011)
Porges, S. W., Macellaio, M., Stanfill, S. D., McCue, K., Lewis, G. F., Harden, E. R., & ... Heilman, K. J. (2013)
Pouw, L. B. C., Rieffe, C., Stockmann, L., & Gadow, K. D. (2013)
Ramos, M., Boada, L., Moreno, C., Llorente, C., Romo, J., & Parellada, M. (2013)
Rende, R. (2014)
Reynolds, S., Bender, R. M., Lawrence, T., & Lane, S. J. (2011)
Rockhill, C. M. (2011)
Rodger, S., & Brandenburg, J. (2009)
Sapountzis, I., & Bennett, L. (2014)
Schimmelmann, B. (2011)
Schneider, M., & Koch, M. (2005)
Sebastian, C. L., & Blakemore, S. (2011)
Seiverling, L., Williams, K., & Sturmey, P. (2010)
Siegel, M. (2012)
Spence, S. (2011)
Stahmer, A. C., Schreibman, L., & Cunningham, A. B. (2011)
Murphy, T. K. (2012)
Sugai, G., & White, W. J. (1986)
Tandon, M., & Luby, J. (2009)
Toda, Y., Mori, K., Hashimoto, T., Miyazaki, M., Nozaki, S., Watanabe, Y., & ... Kagami, S. (2006)
van Haaren, F. (2010)
Verma, R. J., & Mathurina, N. (2009)
Volkmar, F. R. (2001)
Huang, A. (2013)
Chiocchetti, A. G. (2014)
White, S. W., Ollendick, T., Albano, A. M., Oswald, D., Johnson, C., Southam-Gerow, M., . . .  
Sc Palli, L. (2013)  
Wilbarger, J. L., McIntosh, D. N., & Winkielman, P. (2009)  
Wong, V. N. (2009)  
Wu, S., & Gau, S. (2013)  
Yirmiya, N., Sigman, M. D., Kasari, C., & Mundy, P. (1992)  
Zeiner, P., Gjevik, E., & Weidle, B. (2011)  
Zingerevich, C., & LaVesser, P. D. (2009)  

Graph missing or insufficient for visual analysis (n=314)

Adreon, D., & Stella, J. (2001)  
Althoff, R. (2009)  
Arora, T., & Saldivar, B. (2013)  
Azano, A., & Tuckwiller, E. D. (2011)
Begeer, S., Wierda, M., Scheeren, A. M., Teunisse, J., Koot, H. M., & Geurts, H. M.
(2014)
Bregman, J. D. (2012)
Cashin, A. (2008)
Christopher, J. S., Nangle, D. W., & Hansen, D. J. (1993)
Crane, L., Goddard, L., & Pring, L. (2009)
Crooke, P. J., Hendri1, R. E., & Rachman, J. Y. (2008)
Dodd, J. L., Ocampo, A., & Kennedy, K. S. (2011)
Hong, D. S. (2013)
Isbell, J. S., & Jolivette, K. (2011)
Jahromi, L. B., Bryce, C. I., & Swanson, J. (2013)
Karnezi, H., & Tierney, K. (2009)
Kasari, C., Gulsrud, A., Freeman, S., Paparella, T., & Hellemann, G. (2012)
Koegel, R., Kim, S., Koegel, L., & Schwartzman, B. (2013)
Kunce, J. T., & Hemphill, H. (1983)
Kuusikko-Gauffin, S., Jansson-Verkasalo, E., Carter, A., Pollock-Wurman, R., Jussila, K.,
LaCava, P. G. (2005)
Lane, A. E., Dennis, S. J., & Geraghty, M. E. (2011)
Lardizabal, A. (2012)
Lauritsen, M. (2013)
Leist, T., & Dadds, M. R. (2009)
Lerner, M. D., Mikami, A. Y., & Levine, K. (2011)
Lickel, A., MacLean, W., Blakeley-Smith, A., & Hepburn, S. (2012)
Lin, L. (2011)
Ling-Yi, L. (2011)
Loth, E., Happé, F., & Gómez, J. (2010)
Lyons, G. (2011)
Magyar, C. I., & Pandolfi, V. (2012)
May, T., Cornish, K., & Rinehart, N. (2014)
Mazurek, M. O., Kanne, S. M., & Wodka, E. L. (2013)
McAleer, P., Kay, J. W., Pollick, F. E., & Rutherford, M. D. (2011)
McClannahan, L. E., MacDuff, G. S., & Krantz, P. J. (2002)
Melogno, S., & Pinto, M. A. (2014)
Miles, B., & Simpson, R. L. (2001)
Minihan, A., Kinsella, W., & Honan, R. (2011)
Mintz, J. (2008)
Myles, B., & And, O. (1996)
Myles, B., & And, O. (1996)
Obrusnikova, I., & Cavalier, A. R. (2011)
Odom, S. L., Duda, M. A., Kucharczyk, S., Co1, A. W., & Stabel, A. (2014)
Ol, M. (2010)
Parsons, S., & Cobb, S. (2011)
Rämä, I., Kontu, E., & Pirttimaa, R. (2014)
Ranson, N. J., & Byrne, M. K. (2014)
Reilly, C., Hughes, C., Harvey, M., Brigham, N., Cosgriff, J., Kaplan, L., & Bernstein, R. (2014)
Rogers, M., & Myles, B. (2001)
Rue, H. C., & Knoll, M. (2013)
Saggers, B. (2015)
Schaaf, R., & Blanche, E. (2011)
Simmons, K. D. (2014)
Social skills training in teens with high-functioning autism. (2009)
Stevens, H. E. (2011)
Wood, J. J. (2012)
Thomeer, M. L. (2012)
Klin, A. (2011)
Wang, I., Laffey, J., Jee, W., Ma, Y., & Stichter, J. (2016)
Wentz, E., Nydén, A., & Krevers, B. (2012)
(2010)
White, S. W., Koenig, K., & Scahill, L. (2010)
White, S. W., Oswald, D., Ollendick, T., & Scahill, L. (2009)
Participants did not meet age and/or IQ requirements (n=246)
Esch, K., & Fryling, M. J. (2013)
Fo11, R. M., & Garito, J. (2007)
Foster-Cohen, S., Friesen, M. D., Champion, P. R., & Woodward, L. J. (2010)
Gartner, D., & Schultz, N. M. (1990)
Gewirtz, S., Stanton-Chapman, T., & Reeve, R. E. (2009)
Graetz, J. E., Mastropieri, M. A., & Scraggs, T. E. (2009)
İftar, E., Kurt, O., & Çetin, Ö. (2011)
Maisto, A. A., & German, M. L. (1986)
Mazet, P. (1986)
Milavic, G. (2014)
Parker, D., & Kamps, D. (2011)
Pierce, K., & Schreibman, L. (1997)
Powers, M. D., & Thorwarth, C. A. (1985)
Study Not Written In English (n=204)

Baeriswyl-Rouiller, I. (1990)
Barrows, P. P. (2005)
Bjästad, J. F. (2011)
Bovensiepen, G. (2009)
Braconnier, A. A. (1983)
Carrillo, M. H., & Gutiérrez Martínez, M. I. (2013)
Chabane, N. (2012)
Chamak, B. (2013)
Chambry, J. (2006)
Dailly, F., & Goussé, V. (2011)
De Medinaceli, J. C., & Rodríguez, Ó. U. (2004)
De-la-Iglesia, M., & Olivár, J. (2012)
Dionisi, J. -. (2013)
Elmose, M. (2010)
Fonagy, P., & Luyten, P. (2011)
Freitag, C. M. (2012)
Freitag, C. M., Cholemkery, H., & Elsuni, L. (2014)
Klein, A. (2012)
Kuijper, A., & de Rijke, L. (1990)
Laba, H. (2013)
Lainé, F., Tardif, C., Rauzy, S., & Gepner, B. (2008)
Latour, A., -. (2009)
Lemonnier, E. (2010)
Lessard, L., & Coutu, S. (2011)
Lorín, d. R. (2009)
Mastella, M. (2012)
Matsuoka, K., Noro, F., & Kobayashi, S. (1996)
Merley, M., Charles, R., Blanchon, Y., -. , & Rousselon, V. (2013)
Mesquita, M., & Bidaud, E. (2013)
Ornitz, E. M. (1986)
Pourre, F., Aubert, E., Andanson, J., & Raynaud, J. -. (2012)
Salvador, L. - (2008)
Schörry-Volk, E. (2013)
Sørensen, E. U., & Trillingsgaard, A. (1993)
Sprovieri, M. H. S., & Assumpção, F. B. J. (2001)
Sugarman, A. (2011)
Teunisse, J. P., Krellers, F. T., Palmen, A. A., Van Der Sijde, A. A., Aerts, F. M.,
Tonus, A. (2012)
Tuğlu, C., & Şahin, Ö. Ö. (2010)
Participants Not Served in Regular Education Classes (n=80)

Sigafoos, J. (2012)
Burns, B. T., & Ault, R. L. (2009)
Cahill, S. M. (2008)
Campbell, J. E., Morgan, M., Barnett, V., & Spreat, S. (2015)
Cavanaugh, L. K., & Rademacher, S. B. (2014)
Desrochers, M. N., Oshlag, R., & Kennelly, A. M. (2014)
Flood, A., Julian Hare, D., & Wallis, P. (2011)
Whitby, P. (2013)
White, S. W., Ollendick, T., Scahill, L., Oswald, D., & Albano, A. M. (2009)