The Effects of Direct Instruction on Reading Comprehension for Individuals with Autism or Intellectual Disability

by

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Abstract

This study investigated the effects of a Direct Instruction (DI) reading comprehension program on the reading comprehension skills of adolescents with autism spectrum disorder or intellectual disability. Although the effectiveness of DI programs has been well documented in disability and instructional literature, effectiveness of DI for individuals with autism and intellectual disability is sparse. This study examined the effects of *Corrective Reading Comprehension: B1*, a reading comprehension program, on students' acquisition of specific reading comprehension skills (parts of speech, combining sentences with and, identifying contradictions, and identifying relevant/irrelevant information). A single subject multiple-probe across behaviors design was employed to investigate whether a functional relation existed between DI and reading comprehension for this sample. A functional relation between the DI and reading comprehension was demonstrated for each participant across all behavioral conditions. Additional data were collected in the area of reading comprehension using standardized and curriculum-based measures. Implications for practice and future research are discussed.

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CHAPTER I. INTRODUCTION

Statement of the Research Problem

Reading is a complex metacognitive process that contains numerous components which must be mastered in order to succeed. Of these components, the ultimate goal is for individuals to be able to derive meaning from the text, otherwise known as reading comprehension. The importance of reading and reading comprehension is best summarized by a statement from the ERIC Clearinghouse on Disabilities and Gifted Education (1996), "No other skill taught in school and learned by school students is more important than reading. It is the gateway to all other knowledge". Although learning to read is critical to academic success and the ability to function in society, it has been argued that learning to read is not a natural process, and that those who struggle to learn to read, whether it be decoding or comprehension, require systematic and explicit instruction.

Approaches to teaching children to read is perhaps the most studied intervention for school aged children, which is evidenced by the National Reading Panel's (NRP) report that over 100,000 studies on reading have been published since 1966. In 2000, the NRP concluded its task of evaluating existing research in order to identify the best ways to teach children to read. The panel found a combination of strategies of explicit and systematic instruction in phonemic awareness, guided oral reading, teaching vocabulary words, and reading comprehension were among the most effective components in teaching children to read.

The reading instruction program Direct Instruction System for Teaching Arithmetic and Remediation (DISTAR), developed by Engelmann and Becker in the late 1960s, is a reading program that contains the strategies for effectively teaching reading and has extensive research evidence for efficacy. DISTAR came to prominence as a result of Project Follow Through, the largest experiment in the United States ever conducted in education. The findings of this experiment indicated the direct instruction methods developed by Siegfried Englemann (which is now known as *Reading Mastery and Corrective Reading*) produced the highest gains when compared to other methods. Furthermore, Engelmann's methods were found to be effective for diverse groups of students.

Although ample evidence exists for the efficacy and effectiveness of this specific direct instruction model, two subgroups that lack validation for this model is individuals with autism and intellectual disabilities. Autism is a complex, neurological disorder which manifests itself as deficits in communication and language. Autism was not recognized as a disorder by the American Psychological Association until 1980 or as a disability category under the Individuals with Disabilities Education Act until 1990. Since this time, research regarding characteristics and effective treatments for these individuals is emerging. For example, studies have shown that these individuals often score higher on nonverbal versus verbal portions of IQ assessments (Allen, Lincoln, Kaufman, 1991; Mayes & Calhoun, 2003; Rumsey, 1992). Mayes and Calhoun (2007) also found that children with high functioning autism often exhibited weaknesses in learning, attention, and processing speed and performed best on visuo-motor tasks. In addition, individuals with autism often demonstrate higher reading decoding ability and weaknesses in reading comprehension (Chiang & Lin, 2007; Humer & Mann, 2009; Minshew, Golstein, Taylor, & Siegal, 1994; Nation, Clarke, Wright, & Williams, 2006; Tager-Flusberg, Paul, & Lord, 2005).

Direct Instruction (DI) programs developed by Engelmann have yet to be established as evidenced-based programs for individuals with autism and intellectual disabilities; however, given the documented effectiveness of these reading programs, researchers have begun to demonstrate that these programs are effective for these populations. For example, research has shown that *Reading Mastery Plus* was effective in teaching children with autism letter-sound correspondences, blending, segmenting, and word reading (Zayac, 2009), and that *Corrective Reading* programs were effective in teaching students with autism comprehension skills (Flores & Ganz, 2007, 2009; Ganz & Flores 2009). However, each of these studies utilized single-subject designs, were implemented with young children, and utilized less complex cognitive comprehension skills. Only one group design evaluating the effectiveness of the direct instruction reading comprehension program has been published to date (Flores, et al., 2013). The lead author of this study is the same as three of the previously mentioned studies, is limited to younger children, and is focused on less cognitively complex reading comprehension skills.

Purpose of the Study

The purpose of this study is to investigate the effects of the reading comprehension program, *Corrective Reading Comprehension: B1,* on the reading comprehension skills of students with autism or intellectual disability. This study examined the effects of *Corrective Reading Comprehension: B1* on specific skills (parts of speech, combining sentences with and, identifying contradictions, and identifying relevant/irrelevant information) found within the program as well as pre/post performance on an achievement test, the Woodcock Reading Mastery Tests-Third Edition (WRMT-III; Woodcock, 2011). An additional focus was to examine whether students are able to generalize these skills to other reading comprehension

tasks often required within the academic setting, which was measured by a reading comprehension curriculum-based measure (CBM) from AIMSWeb.com.

Given the rise in incidence of individuals with autism as well as the significance of literacy in today's society, the importance of improving reading comprehension for students with autism and/or intellectual disability cannot be understated. Due to IDEA and NCLB, accountability in education is at an all time high; therefore, interventions aimed at improvements in reading which will affect standard of living for these individuals is vital. In determining which interventions are effective for individuals with autism and intellectual disability, replications and extensions of previous research is necessary to document what is considered "evidenced-based interventions."

Justification of the Study

In order to establish the credibility of an intervention and to identify an intervention as evidenced-based, independent replication and extensions of original research is necessary. Although replication research is seen as somewhat "devalued" as opposed to original research, its importance has recently been pushed to the forefront by researcher Brian Nosek. In his seminal work, *Estimating the Reproducibility of Psychological Science* (2015), Nosek and a large team of scientists replicated 100 studies in three top psychology journals (*Journal of Experimental Psychology: Learning, Memory, and Cognition*; *Journal of Personality and Social Psychology*, and *Psychological Science*) in 2008. The researchers were only able to successfully replicate less than half of the original studies, demonstrating a significant need for replication and extension research.

Results from this study will provide a replication of previous research (Flores & Ganz, 2007, 2009; Ganz & Flores 2009) regarding reading comprehension and individuals with autism

as well as extend these studies in that the intervention is a more cognitively complex level in the reading program and is focused on adolescent autism literacy. Furthermore, the entire program is being implemented as opposed to strands of skills or portions of the program. The results from this study will provide additional evidence for educators and practitioners to be able to identify and select an effective educational intervention to address deficits in reading comprehension for individuals with autism and intellectual disability, something which is currently lacking in the literature.

Research Questions

Considering the importance of reading comprehension and the lack of research in this area for individuals with autism and intellectual disability, the research questions involved in this study are:

1. What are the effects of a DI reading comprehension program on student's reading comprehension skills, specifically those found within the DI program (e.g., parts of speech, combining sentences with and, identifying contradictions, identifying relevant/irrelevant information)?
2. What are the effects of a DI reading comprehension program on overall student reading comprehension as measured by a norm-referenced reading achievement test (Woodcock Reading Mastery Tests)?
3. What are the effects of a DI reading comprehension program on student's maintenance of reading comprehension skills one month after instruction ends?
4. Are students able to generalize skills taught within the DI reading comprehension program to other tasks commonly found within the classroom?

A considerable evidence base exists regarding the effectiveness of DI programs in improving the reading skills for various types of students. This researcher hypothesizes that a DI comprehension program will also be effective in improving the comprehension for individuals with autism or an intellectual disability.

The research design utilized to test this hypothesis was a multiple-probe across behaviors design. This particular design is a variation of the multiple baseline design in that baseline conditions are observed intermittently rather than continuously. Three participants included in this study were diagnosed as having either autism or intellectual disability and were in grades five, eight, and ten and demonstrated a need for the targeted instruction.

The primary instrumentation tool consisted of researcher created probes, based on and modeled after strands of skills taught within the *Corrective Reading Comprehension: B1* program. Reliability of these probes was established by calculating Cronbach's Alpha. Additional instrumentation consisted of the WRMT-III. Measures utilized to determine generalization of skills were items from the CBMs of maze subtests from AIMSWeb.com.

Theoretical Framework

Behaviorist learning theory associated with John B. Watson and B. F. Skinner provides the theoretical framework for the intervention included in this study. Reading instruction provided in the *Corrective Reading* program includes effective instructional design principles and teaching behaviors through explicit introduction of skills, mastery at each step in the process, specific correction procedures, gradual fading of teacher direction, adequate and systematic practice throughout, and cumulative review of newly learned concepts. The program consists of teacher scripted delivery of instruction. This teacher-directed approach which focuses on teacher-student interactions, such as opportunities for students to receive reinforcement

throughout the lesson, provides for the most efficient and effective delivery of information. Furthermore, the *Corrective Reading Comprehension* programs break down important skills and information into smaller, manageable units. This cumulative skill development ensures that students master skills gradually and steadily before moving onto more difficult skills. Students are also shown how their performance is improving as they progress through the program. The development of the strands and sequences of the skills within the *Corrective Reading Comprehension* programs are designed to ensure effective and efficient learning of new skills by students with deficits in reading comprehension.

Limitations

The participants included in this study are three students who demonstrated a need for targeted reading comprehension instruction. These students showed a marked improvement across the skills of parts of speech, combining sentences with and, identifying contradictions, and identifying relevant/irrelevant statements. Furthermore, gains in reading comprehension were demonstrated by growth in standard scores for reading comprehension subtests from pre/post analyses of achievement data as measured by WRMT-III. Although significant progress in reading comprehension of these students has been demonstrated, some limitations exist. First, instruction was provided in a one-on-one format by this researcher. This one-on-one instruction minimized off-task behaviors and attention problems commonly demonstrated by two of the students. Generalization to small group or whole group settings cannot be made. Since students included in this study were labeled as having either autism or intellectual disability, generalizations to other disability categories is limited. Also, instruction was provided for students aged 10–16, so generalizations to other age groups cannot be made. The majority of the

instruction was provided by this researcher, so it is unclear if instruction by a classroom teacher will yield similar results.

Definition of Terms

Autism: A condition characterized by impairments in social interaction, communication deficits, and repetitive behaviors or restricted interests.

Curriculum Based Measures (CBM): An approach to measuring the academic growth of individual students so that teachers can evaluate the effectiveness of their instruction (Deno, 2003).

Developmental Delay: any child aged three through nine who exhibits delays in physical development, cognitive development, communication development, social or emotional development, or adaptive development and needs special education and related services.

Direct Instruction (DI): A set of specific reading comprehension programs developed by Englemann and others (depending on the program), which emphasize the methodologies of direct instruction. Initially developed as the DISTAR (Direct Instruction Systems in Arithmetic and Reading) programs in the 1960s.

direct instruction (di): A set of instructional strategies based on explicit introduction of skills, mastery at each step in the process, specific correction procedures, gradual fading of teacher direction, adequate and systematic practice throughout, and cumulative review of newly learned concepts (Gersten, Carnine, & Woodward, 1987).

Intellectual Disability: A category of special education which is defined as intellectual functioning of at least 2 standard deviations below the mean (I.Q. < 70), and deficits in adaptive behavior which adversely affect educational performance.

Maintenance Data: Data collected in single subject methodology after a given period of time (usually a minimum of 2 weeks) to measure student mastery of a skill or concept.

Multiple-Probe Across Behaviors Design: A variation of the multiple baseline design that features intermittent measures during baseline.

Probe: An assessment that measures a student's mastery of a given skill.

Social Validity: the importance and acceptability of a given treatment, treatment goals, procedures, and outcomes.

Summary

The importance of learning to read and reading comprehension is the most important skill taught in schools today. However, some students continue to struggle in this area as a result of ineffective instruction. Research has demonstrated the efficacy of DI reading programs in improving reading skills of a diverse population of individuals, including those who struggle to read; however, research is lacking for teaching these skills to some subgroups, such as those with autism or intellectual disabilities. Although the research is beginning to emerge in this area, the credibility of DI as an evidenced-based intervention for individuals with autism or intellectual disability is lacking due to the small number of studies and limited design. Given the lack of research as well as comprehension as an often identified deficit for those with autism, the focus of this study is to determine if a specific reading comprehension program is effective in improving the reading comprehension skills for this population.

CHAPTER II. REVIEW OF RELATED LITERATURE

'Autism' is a term that was first coined by the Swiss psychiatrist, Eugen Bleuler, in 1911 to describe a group of symptoms thought to be related to schizophrenia; however autism was first systematically studied and described by Leo Kanner in his 1943 seminal paper, *Autistic Disturbances of the Affective Contact*. In this early case study involving eight boys and three girls, Kanner described several common characteristics displayed by the children he was observing. These characteristics constituted a "unique syndrome", and according to Kanner consisted of (a) an inability to relate themselves in an ordinary way to people and situations, (b) an inability to use language for the purpose of communication, and (c) a limitation in variety of spontaneous activities or a desire for sameness. Although he noted other similar characteristics, these three characteristics still serve as the basis for a diagnosis of autism some six decades later.

At essentially the same time of Kanner's description of autism, Hans Asperger also described and defined a similar disorder. Originally published in German in 1944, it was not translated into English by Wing until 1981. The disorder, named after Asperger, described individuals who possessed a lack of empathy, little ability to form friendships, one-sided conversation, intense absorption in a special interest, and clumsy movements. One major distinction between the two disorders was that the individuals Asperger described possessed the functional use of language. This distinction continues to exist today.

Although first described in the early 1940s, these two disorders were not accepted by professionals in the field until much later. Autism was first recognized by the American

Psychiatric Association in 1980 (Asperger's in 1994) and was deemed as one of the 13 disability categories under the Individuals with Disabilities Education Act in 1990. Regardless of the recent acknowledgement of this disorder, the early descriptions of these unique characteristics displayed by certain children have served as the impetus for autism diagnosis and research today.

Characteristics of Autism Spectrum Disorder

The term 'autism' comes from the Greek word "autos" meaning self, in which individuals who display this difference do not seek social interaction – hence becoming an isolated self. Although the definition of autism has evolved and broadened since Kanner's seminal description, the characteristics described by him serve as the basis for diagnoses of autism today as described by *The Diagnostic and Statistical Manual for Mental Disorders* (5th ed.; *DSM-5*; American Psychiatric Association, 2013). The DSM-5 is the most widely accepted classification used by clinicians and researchers for the organization and diagnosis of mental disorders. According to the DSM-5, the definition of autism is:

A. Persistent deficits in social communication and social interaction across multiple contexts, as manifested by the following, currently or by history:

1. Deficits in social-emotional reciprocity, ranging, for example, from abnormal social approach and failure of normal back-and-forth conversation; to reduced sharing of interests, emotions, or affect; to failure to initiate or respond to social interactions.

2. Deficits in nonverbal communicative behaviors used for social interaction, ranging, for example, from poorly integrated verbal and nonverbal communication; to abnormalities in eye contact and body language or deficits in

understanding and use of gestures; to a total lack of facial expressions and nonverbal communication.

3. Deficits in developing, maintaining, and understanding relationships, ranging, for example, from difficulties adjusting behavior to suit various social contexts; to difficulties in sharing imaginative play or in making friends; to absence of interest in peers.

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

1. Stereotyped or repetitive motor movements, use of objects, or speech (e.g., simple motor stereotypies, lining up toys or flipping objects, echolalia, idiosyncratic phrases).

2. Insistence on sameness, inflexible adherence to routines, or ritualized patterns or verbal nonverbal behavior (e.g., extreme distress at small changes, difficulties with transitions, rigid thinking patterns, greeting rituals, need to take same route or eat food every day).

3. Highly restricted, fixated interests that are abnormal in intensity or focus (e.g., strong attachment to or preoccupation with unusual objects, excessively circumscribed or perseverative interest).

4. Hyper- or hyporeactivity to sensory input or unusual interests in sensory aspects of the environment (e.g., apparent indifference to pain/temperature, adverse response to specific sounds or textures, excessive smelling or touching of objects, visual fascination with lights or movement).

C. Symptoms must be present in the early developmental period (but may not become fully manifest until social demands exceed limited capacities, or may be masked by learned strategies in later life).

D. Symptoms cause clinically significant impairment in social, occupational, or other important areas of current functioning.

E. These disturbances are not better explained by intellectual disability (intellectual developmental disorder) or global developmental delay. Intellectual disability and autism spectrum disorder frequently co-occur; to make comorbid diagnoses of autism spectrum disorder and intellectual disability, social communication should be below that expected for general developmental level.

In addition to the three broad areas of classification known today, Kanner also noted several other common characteristics from the children he studied. Commonalities such as (a) excellent rote memory, (b) literalness, (c) inappropriate use of pronouns, (d) refusal of food, (e) good cognitive potential, (f) normal physical appearance, and (g) all products of highly intelligent parents were identified in each of the children that were studied (Kanner, 1943). These characteristics are commonly described as "classical autism" or "Kanner's syndrome", and are prevalent today; however, this disorder is encompassed in a much broader term of what is usually referred to as autism spectrum disorder (ASD). It is not uncommon for individuals with ASD to exhibit one or more of these "symptoms" in addition to the characteristics described in the DSM-V.

Although Kanner's first description of individuals with autism indicated probable normal intelligence (excellent rote memory, good cognitive potential, and normal physical appearance), the ASD umbrella is much wider today and refers to individuals presenting a variety of deficits

ranging from "severe" to relatively "mild and nonclinical" (Maser & Akiskal, 2002). For example, individuals with ASD may exhibit significant cognitive impairments, or have normal or superior intelligence. However, approximately 70% of individuals diagnosed with autism score in the mental retardation range on tests of intelligence (Fombonne, 2005), and approximately 35-40% do not develop spoken language (Mesibov, Adams, & Klinger, 1997). Although many studies have reported the stability of IQ scores over time for individuals with ASD (Ballaban-Gil, Rapin, Tuchman, & Shinar, 1996; Howlin, Goode, Huttin, & Rutter, 2004), it is important to note that some researchers have reported increases in IQ scores over time for these individuals (Lord & Schopler, 1989; Mayes & Calhoun, 1999) especially for those who receive early, intensive intervention (Lovaas, 1987; Smith, Buch, & Gamby, 2000). These findings are especially significant as IQ has been identified as the best predictor of outcome for these individuals (Nordin & Gillberg, 1998).

Regardless of degree of functioning, research has shown that individuals with ASD present some commonalities in regard to cognitive and academic functioning that indicates areas of relative strengths while others serve as relative weaknesses. For example, several studies have reported that young children with autism score higher on nonverbal versus verbal portions of IQ assessments (Allen, Lincoln, & Kaufman, 1991; Mayes & Calhoun, 2003; Rumsey, 1992), indicating that these individuals possess relative strengths in rote learning, which is consistent with Kanner's early description. It is important to note, however, that no differences in nonverbal and verbal IQs were noted in children aged 6–15, indicating that verbal IQs in children with autism might possibly increase over time (Mayes & Calhoun, 2003). Furthermore, Mayes and Calhoun reported that both younger and older children with high and low IQs scored well on similarities, information, and vocabulary subtests of the Wechsler Intelligence Scale for

Children-Third Edition indicating relative strengths in the recall of facts (consistent with Kanner's original description); however, participants scored lower on language comprehension and social reasoning, indicating weaknesses with more abstract and complex skills.

Mayes and Calhoun (2007) found that children with high functioning autism (HFA) exhibited weaknesses in learning, attention, graphomotor, and processing speed that differentiated these individuals from other children with clinical disorders, such as anxiety and depression, and from typical children. Additionally, after comparing students with differing IQ scores, the group with the low IQs performed best on visuo-motor subtests, whereas the group with the high IQs did not, indicating writing problems for children with HFA. Finally, the group with the higher IQs performed poorly on Digit Span, Arithmetic, Coding, Developmental Tests of Visual Motor Integration, and on Weschler Individual Achievement Test written expression subtests, suggesting attention and writing weaknesses.

Additionally, research has shown that individuals with autism possess relative strengths in the area of visual skills (Mayes & Calhoun, 2003). This finding has long been accepted in the field of special education as individuals with autism have described what it is like to have this disorder. For example, Temple Grandin, a well-known individual with autism, described her preference as a visual learner. In her 1993 book, *Thinking in Pictures*, she promotes the use of visual supports when she described how she processed verbal information visually. She states, "Spatial words such as over and under had no meaning for me until I had a visual image to fix them in my memory" (p. 30). In addition to some commonalities regarding cognitive functioning, research has also shown that individuals with autism often share common characteristics regarding communication skills.

Although impairments in communication exhibited by individuals with autism present in a broad spectrum, some commonalties have been noted in the literature. These communication impairments exist in verbal as well as nonverbal communication. It is important to note that when referring to language development, some individuals with autism (those with Asperger's disorder) do not exhibit delays in language; therefore, this subgroup is excluded when referring to language development. Verbal language development for individuals with autism may range from the non-existent use of language to subtle deficits in the use of language such as pragmatics (Tager-Flusberg, Paul, & Lord, 2005), prosody and lack of abstraction (Cashin & Barker, 2009). Approximately 50% of individuals with autism never develop the functional use of communication skills (Bryson, Clarke, & Smith, 1988).

Nonverbal communication is also an area in which individuals with autism exhibit weaknesses. According to Chawarska and Volkmar (2005), nonverbal communication is one of the "most extensively studied" characteristics of autism. They describe nonverbal communication as a reflection of an individual's motivation to communicate and understanding of how to communicate. For example, Asperger noted that the individuals he studied experienced difficulties understanding nonverbal cues conveyed by others as well as a reduction in the quantity and diversity of facial expressions (Klin, McPartland, & Volkmar, 2005). Joint attention and symbol usage are two additional areas in which core nonverbal communication deficits commonly exist (NRC, 2001). In addition to commonalities in cognition and communication, research has also documented similarities in academic achievement of individuals with autism. Among these academic areas, reading is one area that has gained attention in the recent literature.

Reading and Autism

Research has provided the field with information regarding reading characteristics of students with ASD. Although this is a rather heterogeneous group in regard to reading skills (or any other skills), some tendencies have been noted in the literature. One reading pattern of individuals with autism is that of hyperlexia. First described by Silberberg and Silberberg (1967), hyperlexia is the "continuum of word recognition abilities which may exist separately from general verbal functioning" (p. 41). These authors further described hyperlexia as the exceptional ability to read words that are above what is expected given an individual's IQ and at a higher level than the individual's ability to comprehend and integrate words. Hyperlexia is often considered a savant skill, and individuals who possess this skill vary widely in intellectual functioning (Silberberg & Silberberg). Hyperlexia is most often associated with individuals with autism (Nation, Clarke, Wright, & Williams, 2006) with studies reporting the prevalence of approximately 5–10% (Burd & Kerbeshian, 1985). Some speculate that obsessive interest in letters and/or words is one example of one of the autism characteristics of restricted patterns of interest (Grigorenko, Klin, & Volkmar, 2003). It is important to note that despite excellent word recognition skills, individuals who exhibit hyperlexia almost always demonstrate weakness in reading comprehension.

Although hyperlexia is associated with deficits in reading comprehension, researchers have shown that individuals diagnosed with autism without hyperlexia also demonstrate relative weakness in the area of reading comprehension. Nation, Clarke, Wright, and Williams (2006), investigated reading skills of individuals with autism. These authors assessed word recognition, nonsense reading, text reading accuracy, and text comprehension skills. Although variability existed within each area investigated, the authors found that overall, individuals with autism

scored in the average range for word recognition, non-word reading, and text reading accuracy; however, reading comprehension was impaired, a finding consistent with previous research (Frith & Snowling, 1983; Minshew, Goldstein, Taylor, & Siegal, 1994). This is consistent with other findings that decoding and spelling tend to be relative strengths for individuals with autism (Tager-Flusberg, Paul, & Lord, 2005), and that more cognitively complex tasks such as comprehension tend to present difficulty for these individuals (Chiang & Lin, 2007; Huemer & Mann, 2009; Wahlberg & Magliano, 2004).

Prevalence and Etiology of Autism

Current estimates of the incidence of autism are at an all-time high as individuals identified as having autism has increased significantly in the past several decades. For example, in 2000, the National Institutes of Health reported the prevalence as 1 in 500 and then a year later reported the prevalence as 1 in 250. In 2007, the Centers for Disease Control (CDC) estimated that the prevalence of autism was 1 in 150 births. As of 2014, the CDC reports the incidence as 1 in 68 (CDC, 2014). Additionally, the Office of Special Education Programs (OSEP) indicated in the 37th Annual Report to Congress on the implementation of IDEA that approximately 500,000 students ages 6 to 21 had been identified and were receiving services for this disorder during the 2014–2105 school year. Although autism occurs in all racial and socioeconomic groups at about the same rate (CDC, 2010; Fombonne, 2005), research has consistently demonstrated that boys are affected 4 to 7 times more often than girls (CDC, 2000, 2010).

Most agree that at least part of the increase is due to better detection, broader diagnostic criteria, and an increase in public awareness. Since Kanner's estimates of approximately 1 in 10,000 children affected by autism, estimates are much higher today; however, the definition and

eligibility criteria is much broader. Those estimated to have "classic autism" or "Kanner's autism" are much lower.

One event that has had an impact on the increase of individuals with autism is the creation of a specific label of autism. Autism was not officially recognized as a disorder by the American Psychological Association until 1980. Prior to this time these individuals were undiagnosed or diagnosed as having another disorder. In extreme cases, those with the disorder were sometimes referred to as feral children (Candland, 1993). For example, some argue that the Wild Boy of Aveyron actually possessed the disorder (Wing, 1993) and as a result, was probably left in the woods by his parents in the 1700s. Another example of autism being included under another disorder is that autism was once thought to be an early form of schizophrenia (Bender, 1946). In fact, it was classified under schizophrenia in the International Statistical Classification of Diseases and Related Health Problems until 1967. Later, autism was considered distinct from schizophrenia as autism usually manifests itself in a failure to develop rather than in regression and is not associated with fantasy (Volkmar & Klin, 2005).

Change in specific diagnostic criteria noted in different versions of the DSM highlight issues in increase of the prevalence of autism. In 1980, in order to receive a diagnosis of autism, the DSM-III criteria were that individuals exhibit six of six criteria listed in the manual; whereas in 2000, the DSM-IV-TR required only eight of 16 criteria for a diagnosis. Additionally, the DSM-III had only two categories of diagnoses (e.g. infantile autism), and the DSM-IV-TR had five (Autism, Asperger's disorder, Rett's disorder, Childhood Disintegrative Disorder, and PDD-NOS). An additional example of evolving diagnostic criteria is that of the 1980 criteria which requires these individuals exhibit "a pervasive lack of responsiveness to other people," to the 1990 requirement of "a lack of spontaneous seeking to share….achievements with other people"

(Gernsbacher, Dawson, & Goldsmith, 2005). Furthermore, the most current edition, the DSM-V, has eliminated a separate diagnostic label for Asperger's and PDD-NOS and has now included severity levels to distinguish between the amounts of support needed.

One final source of variability in the calculation of the rise in incidence of autism is misinterpretation of data from Reports to Congress on the Implementation of IDEA. Several authors have reported on the specific problems with conclusions drawn from this data (Gernsbacher, Dawson, & Goldsmith, 2005; Lilienfeld & Arkowitz, 2007). Each year school systems are required to provide a count of the number of children with disabilities served. Prior to 1990, autism was not a specific disability category under IDEA; therefore, these authors argue that an increase must follow. In order to illustrate this argument, Gernsbacher, et al., provide additional evidence. The Autism Society of America reported a 1,354% increase in autism from 1991–92 to 2000–01 based on data provided from OSEP's annual reports to Congress. During this same time frame, the incidence of traumatic brain injury (also a new IDEA disability category in 1990) rose 5,059%. Regardless of whether there is an actual increase in the incidence of this disability or an increase in the appropriate identification of individuals with this disorder, the number of individuals identified as having this disorder and receiving services has increased. As a result, many theories regarding the causes of autism have been proposed. A brief history and the most plausible theories are discussed next.

Kanner's observation that the children he studied came from well-educated but "very few really warmhearted fathers and mothers" eventually led to the theory that cold and unloving parents contributed to the development of autism. This theory was promoted by Bruno Bettelheim in *The Empty Fortress: Infantile Autism and the Birth of the Self*, in which he blamed "refrigerator mothers" and their emotional frigidity as the cause of autism. Even though the

concept of "refrigerator mother" was criticized prior to Bettelheim's book, this theory was an accepted explanation for autism until the 1970s. In contrast, the origins of autism are generally regarded today as neurobiological with underlying dysfunctions in the central nervous system (Volkmar & Klin, 2005).

Numerous competing theories regarding the etiology of autism exist, but given the complexity of this disorder, it is plausible that several causes exist. For example, the general consensus regarding the onset of autism is prior to three years of age, whereas symptoms for ASD may not be prevalent until after three for children with childhood disintegrative disorder. Regardless, among these explanations for the etiology ASD are (a) genetic, (b) neurologic, and/or (c) environmental. Of these explanations, research has supported some contentions more than others. Genetic factors are often cited in the literature (e.g., Bailey, et al., 1995; Freitag, 2007). For example, research has shown that among identical twins, approximately 60–90% of the time both will be diagnosed with autism, indicating that a probable genetic link exists. Further, in families with an individual diagnosed with autism, there is an increased (2–8%) risk of having another child with autism (Boyle, Van Naarden Braun, & Yeargin-Allsopp, 2005). Finally, autism has been reported to co-exist with other genetic disorders about 10% of the time (Cohen, et al., 2005). As the distinctions of this disorder have evolved over time, so have the legal aspects of educational service provision and educational identification.

Legislation and Litigation Regarding Disabilities

The No Child Left Behind Act of 2001 (NCLB) and the Individuals with Disabilities Education Improvement Act of 2004 (IDEIA) are two sources of legislation that have significantly impacted the educational system in the United States. NCLB, reauthorized from the Elementary and Secondary Education Act of 1965, is currently and was originally intended to

improve the academic achievement of students in the United States. According to Yell (2005), the five major primary goals of NCLB are to ensure (a) academic proficiency of all students in reading and math by the 2013–2014 school year, (b) all teachers are highly qualified by the 2005–2006 school year, (c) students are educated in schools that are safe, drug free, and conducive to learning, (d) limited English proficient students will become proficient in English, and (e) all students will graduate from high school (p. 131).

These goals are based on the four pillars of (a) stronger accountability for results, (b) more freedom for states and communities, (c) proven education methods, and (d) more choices for parents (USDOE, 2004). The requirements of accountability for results and the use of evidenced-based practices have a direct impact on the educational achievement for students. The accountability provision requires schools to identify academic content standards for children to learn and then assess students to determine if they have learned the standards (Yell, 2005). In order to ensure academic improvement for all students and ultimately to meet adequately yearly progress (AYP), schools are required to test 95% of all students and 95% of certain subgroups, students with disabilities being one of those. Finally, NCLB requires states to use evidenced-based programs and practices in order to receive federal funds. Again, this is meant to ensure improvement in academic achievement of students by preventing ineffective instruction based on fads, fancy, or personal bias.

The federal government set provisions or sanctions regarding schools that fail to make AYP. If for one year a school fails to make adequate yearly progress, no real consequences are applied to the school. The school is to identify areas of needed improvement and should make necessary adjustments. If a school has failed to make AYP for two consecutive years, the school must identify specific areas of improvement and devise a plan to raise student achievement.

Parents also have an option of transferring their child to a higher performing school within the district. If for three consecutive years a school has failed to make AYP, the school must offer additional services such as tutoring or other supplemental services to low achieving and low-income students. If a school has failed to make AYP for four consecutive years, then the school must take corrective measures. Examples of corrective measures that a school can take are adopting a new curriculum, extending the school year or day, replacing school staff who are "relevant to failure to make AYP", and/or restructuring the school's internal organizational structure. Finally, if a school fails to make AYP for five consecutive years, then the school must continue corrective actions and develop alternative governance plans. After six consecutive years of failure to make AYP, the school must implement the alternative governance plans.

NCLB significantly impacts the education of students with disabilities, including those with autism. In order to ensure that students with disabilities receive high quality instruction, the academic proficiency mandates of NCLB apply to these students as well. Data obtained from students with disabilities for the purposes of determining AYP is included with the data from the entire student population. Furthermore, this data is aggregated in subgroups in order to help reduce the achievement gap. In addition, special education teachers must meet highly qualified status just as regular education teachers. Finally, students with disabilities must receive scientifically based instruction just as their nondisabled peers.

Even though Congress eventually stripped NCLB of most of its features by granting waivers to almost every state and recently replaced it with the Every Student Succeeds Act (2015), which returns educational accountability to the states, assessment, accountability, and teacher quality provisions are present in the ESSA. NCLBs impact on the educational system continues to exist through the acknowledgement of a weak educational system, demand for

standards-based reform and accountability. The impact of NCLB continues to be present in the testing requirements of ESSA; however, accountability is left to each state. In addition, NCLB provisions were incorporated into the newly amended special education law, IDEIA.

IDEIA (2004) and subsequent interpretation by the courts have also significantly impacted the special educational system. Originally titled the Education of All Handicapped Children Act of 1975 (EAHCA), this law was enacted to provide equal access to education for children with mental and physical disabilities. EAHCA has been reauthorized several times with some changes being minor and others being substantial. One significant change as it relates to autism was the introduction of this disorder as a separate disability category in 1990. Another substantial change came in 1997 which made significant changes requiring schools to consider students' participation and progress in the general education curriculum and participation in state or district wide assessments (Yell, Shriner, & Katsiyannis, 2006).

Most of the rules and regulations that define how IDEIA operates fall under six major principles that have basically remained unchanged since 1975 (Turnbull & Turnbull, 2000; Yell, 2006). The first major principle is zero reject. Since students with disabilities were often excluded from public education (USDOE, 2010), zero reject was and is intended to ensure that all students with disabilities receive an education, regardless of the nature or severity of the disability. The idea of zero reject is that if a student qualifies for special education services based on one of the 13 eligibility categories, then that student cannot be denied special education services that are designed to provide a free and appropriate public education.

The second major principle of IDEIA is the provision of nondiscriminatory identification and evaluation, meaning that testing and evaluation procedures must not discriminate on the basis of race, culture, or native language. Furthermore, all tests must be administered in the

child's native language, and identification and placement decisions cannot be made on the basis of a single test score. Protection in evaluation is intended to ensure that school systems use appropriate measures to ensure that students are accurately identified and therefore receive appropriate services. This has influenced the education of students with disabilities, as some students have historically been inappropriately identified and placed into special education. According to Zhang and Katsiyannis (2002), minority overrepresentation has been a controversial subject for more than 30 years. Although several minority groups tend to be overrepresented in special education, African American males have received the majority of the attention as their inclusion in high incidence disabilities (emotional disturbance and mental retardation) exceeds their normal representation. To illustrate this issue, the USDOE (1997) reported that in 1992 African Americans represented 16% of the total population; however this group comprised 32% of the students identified as having mild mental retardation and 24% of the students with emotional disturbance. Mandated evaluations are intended to ensure that students with disabilities are properly evaluated and identified so they receive appropriate services.

The third major principle of IDEIA is the provision of a free and appropriate public education (FAPE), meaning that the education of individuals with disabilities is to be provided at the public's expense and with no cost to the parents. Appropriate means that an eligible student should receive special instruction designed to meet his or her individual needs. This appropriate education is detailed in each student's individualized education program (IEP). The IEP is the cornerstone of a FAPE and is a written document containing (a) a statement of the present levels of educational performance of the child, (b) a statement of annual goals, including short-term instructional objectives, (c) a statement of the specific educational services to be provided to

such child, and the extent to which such child will be able to participate in regular educational programs, (d) the projected date for initiation and anticipated duration of such service, and (e) appropriate objective criteria and evaluation procedures and schedules for determining, on at least an annual basis, whether instructional objectives are being achieved (IDEIA, 2004). Furthermore, local or regional educational agencies must review, and where appropriate revise, each child's IEP at least annually (IDEIA, 2004).

The concept of FAPE to students with disabilities has evolved from the idea of access to one of accountability since the passage of EAHCA in the 1970s. Parents and advocates of students with disabilities pushed for equal access for these individuals because historically, they had been excluded from public education systems. This movement was met with great success, and as equal access was granted, the focus shifted to accountability. This movement toward accountability is evident in the recent legislation of IDEIA and NCLB. The focus now for students with disabilities is ensuring that these students receive an appropriate and meaningful education.

There has been some disagreement in the past as to what constitutes a FAPE and the courts have played a defining role in the interpretation of this major principle of IDEIA. The Rowley case (1982) serves as an example of this. The Rowley case was the first case under IDEA that was heard by the Supreme Court. In considering if the school had denied Amy a FAPE, they considered one major issue, the definition of FAPE. The Supreme Court ruled in *Hendrick Hudson Central School District v. Rowley* (1982) that districts must provide a "basic floor opportunity" consisting of "specialized instruction and related services which are individually designed to provide some educational benefit to the handicapped child." Schools were not required to provide services to ensure the best possible education to students with

disabilities. Although the court did not establish a specific test that would determine if schools were providing a FAPE, they did provide two guidelines to help the lower courts. The first part of the test was designed to examine whether the school was in procedural compliance with IDEA. The second part of the test was designed to examine if the IEP was "reasonably calculated" so that the student with a disability could receive educational benefits. If the answer to both of these questions is yes, then the school has met its obligation.

The fourth major principle of IDEIA is the notion of least restrictive environment (LRE). The guiding principle is that students with disabilities should be educated alongside their non-disabled peers "to the maximum extent appropriate". The reasoning is that students with disabilities have been discriminated and segregated in the past, and to ensure that this does not continue to happen, the LRE mandate was included in IDEA. IDEA requires that students with disabilities be educated with children without disabilities to the maximum extent appropriate and that students with disabilities be removed to separate classes or schools only when the nature or severity of their disabilities is such that they cannot receive an appropriate education in a general education classroom with supplementary aids and services (IDEIA, 2004).

IDEA creates a presumption in favor of inclusion in the general classroom by requiring that a student's IEP contain a justification and explanation of the extent, if any, to which a child will not participate with nondisabled peers in the general academic curriculum, extracurricular activities, and other nonacademic activities (e.g., lunch, recess, transportation, dances). To ensure that each student with disabilities is educated in the least restrictive environment appropriate for her needs, school districts must provide a continuum of placement and service alternatives. Despite legislative requirements, the interpretation of LRE has received significant attention in the court systems.

The court system has had a major impact on the interpretation of what constitutes LRE and how LRE decisions should be made. For example, in 1983, the 6th Circuit Court of Appeals ruled in *Roncker v. Walter* that in a case where the segregated facility is considered superior, the court should determine whether the services that make that placement superior could feasibly be provided in a non-segregated setting. The 5th Circuit Court of Appeals held in 1989, in the decision of *Daniel R.R. v. State Board of Education* that students with disabilities have the right to be included in academic and the court developed a two-part test. The first part requires schools to consider if education in the regular classroom, with supplementary aids and services, can be satisfactorily achieved. The second part requires schools to consider that if it cannot, and the student is removed, how he/she can be mainstreamed to the maximum extent appropriate. Furthermore, the 9th Circuit Court of Appeals decided in *Rachel H.* that certain factors should be taken into consideration when determining if the LRE for a student with a disability is appropriate. This court developed a four pronged test which requires schools to consider (a) educational benefits of the regular versus the special classroom, (b) non-academic benefits of regular education versus special classroom, (c) effect of the student on the education of others, and (d) the cost of mainstreaming. However, the 4th Circuit Court of Appeals found in *Hartmann v. Loudoun County Board of Education*, a case involving a nonverbal student with autism, that placement in the general education classroom was inappropriate because of the student's behaviors. This court established that mainstreaming is not required when (a) a student with a disability would not receive educational benefit, (b) any marginal benefit from mainstreaming is significantly outweighed by benefits in a separate setting, and (c) the student is a disruptive force in the classroom.

The fifth principle of IDEA is due process safeguards. Procedural safeguards are included in IDEA to ensure that students with disabilities have a legal recourse when their rights have been violated. These due process rights are extensive and examples include the right to impartial hearings when parents and schools do not agree, notice to parents regarding evaluations, placement, etc., and independent evaluations. Furthermore, schools must provide due process safeguards to protect the rights of children with disabilities and their parents. Two examples of due process rights are that parental consent must be obtained for initial and all subsequent evaluations and placement decisions regarding special education, and schools must maintain the confidentiality of all records pertaining to a child with disabilities and make those records available to the parents. When parents of a child with disabilities disagree with the results of an evaluation performed by the school, they can obtain an independent evaluation at public expense. When the school and parents disagree on the identification, evaluation, placement, or provision of a free, appropriate public education and related services for the child, the parents may request a due process hearing. States are also required to offer parents an opportunity to resolve the matter through mediation by a third party before holding a due process hearing. Parents have the right to attorney's fees if they prevail in due process or judicial proceedings under IDEA. The law also includes provisions that allow the court to award reasonable attorney's fees to the prevailing school district against the attorney of a parent, or the parent who files a complaint that is frivolous, unreasonable, without foundation, or filed for any improper purpose, such as to harass.

Finally, the sixth major principle of IDEA is parent and student participation as the importance of parental participation has increased with each reauthorization of IDEA. IDEA recognizes the important role that parents play in the education of students with disabilities, and

IDEA requires that parents be notified and have an opportunity to participate in decision making of their child's education. Schools must collaborate with parents and students with disabilities in the design and implementation of special education services. The parents' (and, whenever appropriate, the student's) input and wishes must be considered in IEP goals and objectives, related-service needs, and placement decisions.

Given the legislative and litigation mandates regarding students with disabilities, the placement of these individuals and students with autism into the general education setting will continue to increase. However, these students will continue to need educational programming designed to meet the individual needs of each student. In considering educational programming for these students, it is important to examine which educational interventions are empirically validated.

Effective Instructional Practices

According to the NRC (2001), "Education, both directly of children, and of parents and teachers, is currently the primary form of treatment in autism" (p. 12). Although there is no known cure for autism, early, intensive intervention has been shown to be one of the most effective interventions for these individuals (Handelman & Harris, 2000). In a meta-analysis of the early intervention behavioral intervention (EIBI) for children with autism, Eldevik and colleagues (2009) reported an average large effect size of 1.10 for change in IQ for those individuals who received EIBI. This finding is supported by a previous meta-analysis by Reichow and Wolery (2009) who reported a moderate effect size of 0.69 for change in IQ for individuals who received EIBI. One of the primary differences that led to differing results in these two studies is that the latter focused solely on studies utilizing replications of the Lovaas UCLA Young Autism Project. Additionally, Eldevik and colleagues reported an average

moderate effect size of 0.66 for change in the adaptive behavior composite examined in these studies.

According to the National Research Council (2001), interventions and educational services should begin as soon an individual is suspected of having this disorder and should include a minimum of 25 hours per week year round. Furthermore, the student should be engaged in systematically planned activities that are defined by individual instructional objectives (p. 6). Although priorities of instruction often focus on the hallmark deficits associated with autism, cognitive and academic development should also be included in the child's educational goals.

Several effective comprehensive programs, such as the University of California at Los Angeles Young Autism Project and the Pivotal Response Model at the University of California Santa Barbara, exist and have evidence to support their effectiveness for individuals with autism; however, most professional agree that no one program is effective for all individuals with autism (Dunlap & Fox, 2002; Heflin & Simpson, 1998; Powers, 1992). According to the NRC, the similarities of these programs far outweigh the differences. In a review of the literature regarding effective educational practices for individuals with autism, Iovannone and colleagues (2003) argue that effective practices are based on a broad set of characteristics rather than specific characteristics or programs and that common areas of general consensus exist among professionals regarding effective educational practices for these students. According to Iovannone et al., six empirically supported elements exist and should be incorporated into the curriculum for these individuals and consist of (a) individualized supports and services for students and families, (b) systematic instruction, (c) comprehensible/structured learning

environments, (d) specialized curriculum content, (e) functional approach to problem behavior, and finally (f) family involvement.

Individualized supports and services for students and families are required by IDEA and are documented through the child's IEP. Individualized supports and services should be based on preferences, needs, and learning characteristics and should also incorporate high rates of student engagement. These individualized supports and services may range from one-to-one discrete trial teaching to independent work settings to group instruction depending on the individual's needs. A second component, systematic instruction, consists of well-planned instruction that carefully targets skills to be taught, planning when and how to provide instruction, and determining data collection methods to evaluate student progress. Structured learning environments provide students with necessary information so that students can make sense of their environment. Structured learning environments are often complemented with the use of visual cues; however, research regarding the effectiveness of visual supports is limited. Specialized curriculum content focuses instruction of the hallmark deficits of autism – language or communication and social interaction. Functional approach to problem behavior refers to the use of functional behavioral assessment to address behavioral problems as they arise in students with autism. Family involvement, also required by IDEA, has long been identified as essential in helping students with disabilities and is just as important for students with autism as interventions for these individuals should be implemented across all settings.

Although disagreements exist regarding the type and intensity of educational services, some interventions have significantly more empirical support than others. Of these interventions, Applied Behavior Analysis (ABA) has been examined extensively in the literature for over forty years.

Applied Behavior Analysis (ABA)

Interventions for individuals with autism based on ABA was originally developed by Ivar Lovaas in the 1960s and is one of the most widely accepted interventions for individuals with autism, primarily because of its documented effectiveness. Furthermore, ABA comprises the majority of intervention research for individuals with ASD (NRC, 2001). In a meta-analysis of early intensive behavioral interventions (a form of ABA) for children with autism, Eikeseth (2009) found that higher quality studies (studies scored for the highest scientific value and magnitude of results), all assessed ABA techniques rather than other techniques. Furthermore, Eikeseth concluded that ABA is a "well-established" technique, as intensive ABA by trained therapists demonstrated effectiveness in enhancing global functioning skills of children with autism. Additionally, the authors concluded that no other treatment methodologies (including TEACCH) were found to be "well-established" or "probably efficacious."

ABA teaching methodologies are based on the theory of behaviorism, which states that directly observed behaviors can be measured, trained, and changed through the use of reinforcement and punishment (operant conditioning). Initially described by Baer, Wolf, and Risley (1968), the seven components described in their article, *Some Current Dimensions of Applied Behavior Analysis*, continue to serve as the framework some forty years later; however, ABA is often confused with specific methodologies, such as discrete trial teaching, rather than as a systematic method designed for teaching new skills and targeting behavior change. According to McClannahan and Krantz (2000), ABA "should not … be characterized by any one procedure."

Components described by Baer, Wolf, and Risley (1968) are (a) application, (b) behavior, (c) analysis, (d) technological, (e) conceptually systematic, (f) effective, and (g) generalizable.

First, ABA is applied in that it focuses on skill sets that are of social significance, rather than theoretical importance, and contributes a meaningful difference in the life of the individual. Second, the behavioral component referred to by these authors denotes the actual behavior itself, not simply what the subject reports regarding the behavior. Third, data collected in regard to behaviors must be measured precisely. The authors refer to the analytic portion of ABA as "… a believable demonstration of the events that can be responsible for the occurrence or non-occurrence of that behavior" (p. 94). Fourth, technological refers to the ability of another researcher to replicate the procedure. Fifth, conceptually systematic refers to the descriptions of procedures and their relevance to principle of focusing on a disciple rather than a bag of tricks. Sixth, effectiveness refers to the practical significant of the results of the intervention. Results should indicate large enough results of practical value. Finally, generalizability refers to the effect of the intervention lasting over time, transferring to different environments, and spreading to other behaviors.

Several specific methods utilizing ABA techniques have empirically-based evidence to support use for individuals with ASD. Although this list is not all-inclusive, the most widely used methods will be discussed here. Among these techniques are discrete trial teaching, task analysis, chaining, prompting, and fading.

Discrete trial teaching. Discrete trial teaching (DTT) is a method of teaching that is often erroneously used synonymously with ABA. ABA consists of many components, with DTT being one of them. A discrete trial is a 5 to 20 second unit of instruction provided in a one-to-one situation in a distraction free environment (Smith, 2001). According to Smith, DTT consists of five parts. The first part is the cue in which the teacher gives a direction, such as "Touch your nose." The second component consists of a prompt in which the teacher provides an additional

stimulus that increases the probability that the cue or teacher direction will occasion the desired response. For example, the teacher may model "touching your nose" or he/she may provide physical prompting for the student. The third component of a discrete trial is the student's response to the cue. The fourth component is the consequence, which consists of reinforcement if the student demonstrates the correct response, or a "no" if the student demonstrates an incorrect response. The fifth component of a discrete trial consists of an intertrial interval that is approximately a five second break between presentations.

Discrete trial teaching is perhaps the most extensively studied intervention for individuals with autism. Research has shown this technique to be effective in reducing stereotypical behaviors (Dib & Sturmey, 2006), correct color adjective use (Miranda-Linne & Melin, 1992), and communication (Goldstein, 2002).

Task analysis and chaining. Task analysis and chaining are two techniques that are based on ABA methodology that are commonly utilized to teach more complex skills to individuals with autism. According to Alberto and Troutman (2009), a task analysis is the process of breaking down complex behaviors or tasks into their individual parts. For example, one could break a more complex task of ordering a pizza into simpler steps, such as decide what is wanted, look up number in telephone book, dial the number, give order to cashier, get money and tip ready, and wait for delivery. Given differing cognitive abilities of students, the use of task analysis for individuals is advantageous because it can be tailored for individual needs by skipping steps for some or breaking steps down even further for others (Matson, Benavidez, Compton, Paclawskij, & Baglio, 2006).

The individual steps in a task analysis forms a behavioral chain. A behavioral chain is a sequence of behaviors, all of which must be performed in order to receive reinforcement

(Alberto & Troutman, 2009). Two forms of chaining exist – forward chaining and backward chaining. Forward chaining begins with the first element in the chain and progresses to the last element, whereas backward chaining teaches the last component first and then adds one element at a time.

Research has shown the effectiveness of using task analysis and chaining in teaching skills to individuals with disabilities. In a study involving three males (one with autism) with mental retardation, Stokes and colleagues (2004) used a ten-step task analysis as a part of a treatment package to teach bowel hygiene. These authors reported that all three participants were able to perform the ten steps in the process and these skills were generalized. Additionally, a study by Saloviita and Tuulkari (2000) demonstrated the effectiveness of task analysis in teaching various grooming skills to an individual with a moderate intellectual disability. Blew, Schwartz, and Luce (1985) used a task analysis and forward chaining procedure along with peer models to teach children with autism. Results indicated that the participants learned and maintained community skills. Other strategies that are sometimes utilized simultaneously with task analysis and chaining are prompting and fading of supports.

Prompting and fading. Prompting is strategy that has been extensively researched in disability literature. Prompting is an additional stimulus that increases the probability that the cue or teacher direction will occasion the desired response (Alberto & Troutman, 2009). Several different varieties of prompting exist and support for the effectiveness of each has been established in the literature. Verbal prompts, visual prompts, and physical prompts are three types of prompts that are commonly used in educational settings.

Verbal prompts are often used in education and several types exist. One such type is the use of rules as verbal prompts (Alberto & Troutman, 2009). For example, a reading teacher,

when teaching cvc*e* words, might use the rule "we say the name of the letter when an *e* is at the end of the word." Further verbal prompts might consist of questions such as, "Is there an *e* at the end of the word?," then "What do we say for this letter (the vowel)?" Another type of verbal prompt is the use of instructions as verbal prompts. If a teacher says that it's time for lunch and the students do not get up, the teacher might provide an additional verbal prompt in the form of a directive, such as "the green group may line up at the door." One final example of a verbal prompt is the use of hints. For example, a reading teacher might give a student who is trying to decode the word "meat" the hint the / ea / says / e /.

Visual prompts are also common in educational settings and are commonly used with students with autism through the use of sequenced picture prompts. For example, as a reminder of the steps in a hand washing procedure, a teacher might post the individual steps in the procedure (task analysis) in the area where the student is expected to wash his/her hands. Additionally, visual prompts may also be in the form of words. For example, the use of a written schedule or a grocery list are both examples of visual prompts that might be used with students with autism.

Finally, physical prompts are a type of prompts that are often used with younger children or children with more severe cognitive and/or orthopedic impairments and are usually reserved for motor behaviors (Alberto & Troutman, 2009). A basketball coach, for example, might provide physical prompts when teaching players correct shooting form. In educational settings, a teacher might use physical prompting trying to teach students how to tie their shoes or button their own pants or zip their own sippers.

Although prompts increase the efficiency of student responses, prompts should be faded, or gradually withdrawn, as soon as it has been determined that prompts are no longer needed.

According to Alberto and Troutman (2009), prompts can be faded in four ways. First, prompts can be faded through the use of decreasing assistance (also called most-to-least assistance) which uses heavy physical assistance in the beginning which is then faded to light physical assistance as the student becomes more competent. Another type of fading procedure is graduated guidance. Graduated guidance requires the teacher to make moment-to-moment judgments regarding the amount and type of prompting during a given activity. Time delay is another type of fading procedure in which the timing of the prompt is changed. Time delay can also be thought of as wait time. Finally, increasing assistance is another type of fading procedure. Increasing assistance (least-to-most assistance) is the opposite of decreasing assistance and results in the teacher using the least amount of prompting necessary before giving additional prompting as necessary.

Research has shown a variety of prompting and fading procedures to be effective in teaching individuals with autism a variety of behaviors (MacDuff, Krantz, & McClannahan, 2001). In a study completed by MacDuff and colleagues (1993), the authors demonstrated the effectiveness of visual prompts in the form of photographic activity schedules and graduated guidance in teaching on-task and on schedule behavior. Results indicated that this was an effective procedure in teaching students with autism lengthy response chains, as well as to independently change activities, and change activities in different group home settings in the absence of immediate supervision and prompts from others. In another study, researchers demonstrated the effect of a time delay fading procedure on spontaneous verbal responding in seven children with autism (Charlop, Schreibman, & Thibodeau, 1985). Results of this investigation indicated that time delay was effective in teaching individuals with autism to

request items spontaneously and requesting behavior was generalized across settings, people and situations.

The majority of research regarding individuals with autism has focused on teaching methodologies rather than specific curricula as an intervention. Considering the effective components of educational programs for students with autism, it is necessary to determine effective ways to teach reading to these students. Effective reading models have been identified, but have yet to be empirically-validated for individuals with autism. Therefore, significant aspects of literacy as well as previous reading research will be discussed.

Significance of Literacy

Literacy is a common academic focus for students, both for those with and without disabilities; however, the focus of literacy skills for individuals with autism has received limited attention as evidenced by the shortage of research in this area. Most interventions for these individuals commonly focus on hallmark deficits of this disability, such as communication and social interaction, but literacy skills are no less important for these individuals than any other. Literacy is a prerequisite skill for essentially all academic curricula and is associated with successful post-school outcomes (Taylor, 1989) and is necessary for independent functioning (Wahlberg & Magliano, 2004). For example, the ERIC Clearinghouse on Disabilities and Gifted Education (1996) reported, "No other skill taught in school and learned by school students is more important than reading. It is the gateway to all other knowledge" (pg. 1).

Given the significance of reading, it is important to examine essential aspects of tis essential skill. The following portion of this manuscript examines two prevalent perspectives, whole language and code-based strategies, regarding reading instruction. Additionally, effective elements of reading instruction as reported by the National Reading Panel (2000) will be

discussed along with an empirically-validated reading program, Direct Instruction, which has shown to be effective for a variety of students. Finally, research regarding reading interventions for individuals with autism will be discussed.

Perspectives on Reading Instruction

Although several different perspectives regarding reading instruction exist, meaning-emphasis or whole language and code-based are two orientations regarding reading instruction that continue to receive considerable attention in the literature. These two approaches are in direct contrast with one another and have been the source of much debate since the 1960s, when Chall (1967) described the "Great Debate." In this study, Chall compared the effectiveness of whole language versus code-based approaches to beginning reading instruction. Although phonics based instruction is clearly the more effective approach of the two (NRP, 2000), both deserve consideration as each has had a significant impact on reading instruction in the past several decades.

Whole Language

The concept of whole language is complex and varying definitions of this strategy exist. According to Lapp and Flood (1992), the whole language approach to reading instruction represents a philosophy about reading rather than one specific instructional methodology. Furthermore,

> Language is a natural phenomenon and literacy is promoted through natural, purposeful language function. It has as its foundation current knowledge about language development as a constructive, meaning-oriented process in which language is viewed as an authentic, natural, real-world experience, and language learning is perceived as taking place through functional reading and writing situations. (Lapp & Flood, p. 458)

The whole language approach to reading is based on constructivism, which emphasizes the importance of the mind in making sense of information or constructing it. That is, constructivism is based on the belief that individuals generate knowledge and meaning from their own experiences. Therefore, the whole language approach to reading focuses on the learning environment that should be created for developing readers (Tadlock, 2004). According to whole language supporters, teachers should focus on motivation, access to good literature, numerous reading opportunities, focus on meaning, and instruction to help students use meaning clues to determine the pronunciation of unknown words.

The whole language philosophy, which saw its peak in popularity in the 1980s and 1990s, emerged partly from the work of Ken Goodman in the late 1960s. Goodman based his theory on the premise that reading is a "psycholinguistic guessing game" in which the reader uses a holistic approach to reading. Holism, according to Weaver (2002), is based on the idea that readers do not learn to read by analyzing component parts. Additionally, Weaver argues that language should be kept whole, not fragmented into skills and that literacy skills and strategies are developed in the context of the whole, authentic literacy events (Weaver, 1990).

Goodman's work was also based on socio-psycholinguistic theory. According to Brockman (1994), this theory is based on three basic principles. The first principle is that making meaning is more significant than identifying words. Readers rely on what is already known in order to comprehend. Second, language is natural and should not be broken down in order to be learned. Finally, reading is a process in which the reader is deliberately looking for meaning.

According to Brockman (1994), four principles guide whole language instruction. First is the principle that language is whole, which as stated earlier, should be taught as a whole and not broken down into component parts. Second is the principle that written language is language, so what is true for language is also true for written language, meaning that language is a natural phenomenon and that reading is promoted through natural language function (Lapp & Flood, 1992). In other words, children are expected to learn to read and write as they learned to talk, gradually and without a great deal of instruction (Weaver, 1990). No distinction is made between learning to read, then reading to learn. Third is the principle that the major purposes of language are the creation and communication of meaning. Fourth is the principle that language is social and should promote social interaction. The last two principles refer to the environments and the manner in which reading instruction should be taught.

Although whole language instruction is a popular philosophy often guiding reading instruction for many students, a paucity of research exists regarding its effectiveness for all readers. For example, in a meta-analysis of whole language instruction for students from low-SES households, Jeynes and Littell (2000) found that primary school children with low-SES do not benefit from whole language instruction, compared to basal instruction.

According to Moats (2000), several flaws exist in the whole language theory. First, learning to read is not a natural process and that most individuals must be taught to read through the use of letter sound correspondence. Second, exposure to print is not enough for most individuals to be able to learn to read. Again, phonological awareness and the use of letter sound correspondence is necessary to learn to read. Third, spoken language and written language are very different. Fourth, phonics is the most important aspect of learning to read, so teaching letter-sound correspondences including vowels and sounding out unfamiliar words are integral

parts of learning to read. Fifth is that word guessing, as Goodman (1967) suggests, leads to errors when reading.

Given the flaws that exist with the whole language approach to reading, methods that address weaknesses of this type of instruction are worth investigating. Of several different methods, code-based instruction is one approach which has received considerable attention in the literature and is a common method for teaching reading to beginning readers (Adams, 1990; NRP, 2000).

Code-based Instruction

Code-based reading programs are those programs that emphasize letter-sound correspondences and the reading and writing of words composed of those correspondences. Also known as phonics-based programs, code-based programs utilize the alphabetic principle to recognize familiar words accurately and automatically and decode new words independently (Carnine, Silbert, Kame'enui, & Tarver, 2004). Code-based programs control words initially so that the words are made up of letters that make the same sound. For example, a student would need to have mastered the sounds *r*, *a*, and *t* before learning to read the word *rat*. Furthermore, the words would be controlled so that initially, only words that used those same sounds (mainly vowel sounds) would be introduced. The words *hat* and *band* might also be introduced at the same time but a word like *hay* would not be introduced until later. According to Carnine et al., code-based reading programs also emphasize oral reading and sounding out as well as reading words in isolation and reading words accurately. All of these components are in direct contrast to whole language methods.

The research is clear that code-based reading instruction is the more effective approach in reading instruction (NRP, 2001). This has long been documented since the 1960s when Chall

(1967) compared look-say approaches (whole language) to phonics approaches. More recently, *Becoming a Nation of Readers* (1985), Adams (1990), and the National Reading Panel (2000) have also provided evidence to support the use of phonics based instruction in initial reading instruction. However, there is a need to examine the individual components of code-based instruction as well as the empirical support for each of these areas. The following section will investigate the broad areas of reading instruction. Furthermore, it will discuss findings of the National Reading Panel (NRP), which is the most recent, comprehensive review of reading research.

Essential Components of Reading Instruction

Reading can be conceptualized in a variety of ways, but the organization presented here will be modeled after the research focus of the National Reading Panel (2000). Alphabetics, fluency, and comprehension are the three broad areas of reading that will be addressed. Furthermore, subgroups of each area will also be examined.

Alphabetics

Alphabetics refers to concepts and skills needed to read and write words. These skills are organized under the categories of phonological awareness and phonics. Adams (1990) reported in her analysis to the literature that knowledge of letter names is the single best predictor of success in early reading achievement. According to Carnine, et al. (2004), phonological awareness is the awareness of larger parts of spoken language as well as the smaller parts that include words and syllables, rhyming, and alliteration. The smallest components of spoken language are phonemes and are a subcategory of phonological awareness. Approximately 41 phonemes exist in the English language and Adams reported that the ability to discriminate

between phonemes, such as the ability to break syllables down into component phonemes and phoneme manipulation, was a second strong predictor success in early reading achievement.

Another component of alphabetic is phonics instruction. According to Carnine et al. (2004), phonics instruction teaches relationships between letters and individual sounds of spoken language and includes terms such as letter-sound correspondence to refer to these relationships. The combination of instruction in phonological awareness and letter-sounds appears to be the most favorable for successful early reading (Haskell, Foorman, & Swank, 1992; Shippen, Houchins, & Steventon, 2010).

Fluency

The second essential component of effective reading instruction is fluency. Fluency refers to the ability of the reader to quickly, accurately, and with proper expression. According to Adams 1990, "the ability to read words quickly, accurately, and effortlessly is absolutely critical to skillful reading comprehension" (p. i). Although there is a close relationship between fluency and reading comprehension (Pinnell, Lyons, DeFord, Bryk, & Selzer, 1995), reading fluency is the "most neglected reading skill" (Allington, 1983).

According to the National Reading Panel, two primary approaches are utilized to improve fluency in readers. The first is repeated oral reading practice or guided repeated oral reading practice and the second refers to formal efforts to increase independent or recreational reading. According to the meta-analysis of the literature completed by the NRP, results of studies investigating the effects of this approach demonstrated consistent positive impact on word recognition, fluency, and comprehension for students including those at risk and those with reading disabilities for those experiments investigating repeated oral reading or guided repeated oral reading; however, the panel found no evidence suggesting that formal efforts to increase

independent or recreational reading (e.g. silent sustained reading, accelerated reader) are effective in improving fluency or overall reading achievement.

Comprehension

Reading comprehension is perhaps the most important skill learned in school and is the culminating activity of each of the prerequisite skills discussed above. Additionally, Mastropieri and Scruggs (1997) argue that reading comprehension is "the most important academic skill learned in school" (p. 1). Furthermore, research has demonstrated that reading comprehension is often a skill in which individuals with autism demonstrate difficulty.

Vocabulary development is an essential component of reading comprehension. According to the NRP (2000), vocabulary instruction leads to improvements in comprehension. In an inspection of research studies, the NRP found five basic methods of teaching vocabulary which are (a) explicit instruction, (b) implicit instruction, (c) multimedia methods, (d) capacity methods, and (e) association methods. The NRP indicated several implications for providing vocabulary instruction. The Panel suggests that no one method is optimal for teaching vocabulary, indicating that a variety of methods should be used. Of these methods, the Panel reported that vocabulary should be taught explicitly and implicitly with repetition and multiple exposures and that vocabulary can be learned through the use of computer technology and incidental learning. Furthermore, the Panel reported that actively engaging students results in large gains and that tasks may need to be restructured when necessary.

Text comprehension is the ultimate goal of the process of reading and is also a result of each of the individual components previously discussed. According to Carnine and colleagues (2004), literal comprehension, sequencing, and summarization are three basic comprehension skills that are the focus in the early primary grades. The NRP (2000) identified 16 types of

instructional strategies used to improve reading comprehension. Among these strategies are the use of graphic organizers, mental imagery instruction, reciprocal teaching, prior knowledge, and question generation (Shippen, et al., 2010).

One commercially available reading program, Direct Instruction or DI, is based on what is known regarding empirically-validated, effective reading strategies. Components of this program include each aspect of effective reading instruction discussed above. Therefore, it is worth investigating this technique, as well as the research base supporting its effectiveness for individuals with disabilities, particularly those with autism.

Direct Instruction

Historically, direct instruction has been defined in a variety of ways by professionals in the field of reading, but for the purposes of this paper, the description of direct instruction (DI) will be that as described by Carnine and colleagues (2004) and Engelman and Carnine (1982), which uses explicit and systematic methods for teaching reading skills. According to Gersten (1985),

> Direct instruction shares many features with the task analytic, behavioral approaches commonly utilized in special education; namely a belief in the utility of structured curricula materials, a concern with reinforcement of appropriate responses, the modeling and shaping of correct responses, the use of task analysis, and the continuous assessment of student performance. (p. 42)

Furthermore, Direct Instruction, or DI, as discussed here includes effective instructional design principles and teaching behaviors derived from research and is incorporated into a set of published instructional programs (Marchand-Martella, Slocum, & Martella, 2004). The curriculum DI, consists of several commercially available reading, writing, and math programs

initially developed by Engelman in the late 1960s. DI is based on DI methodologies and is composed of many elements, some of which will be discussed here.

Direct Instruction provides for the use of detailed scripts that teachers are to follow. According to Watkins and Slocum (2004), scripts serve two purposes. First, lessons are scripted so that students will have access to well-designed instruction. This well-designed instruction refers to the analysis of the content that is to be taught to specific wording of explanations. Second, the lessons are scripted to relieve teachers of "designing, field-testing, and refining" every subject that is taught. The use of scripts helps relieve teachers of the hours of planning, as expert designers have completed the task.

Another effective element of DI is the careful sequencing of skills. DI includes four guidelines that have been established for determining the sequence of skills to be taught (Watkins & Slocum, 2004). First, prerequisite skills should be taught which are necessary for other skills. For example, letter-sound correspondences should be taught prior to sounding out words. Second, examples of a given skill should be taught prior to exceptions. Once students have mastered examples, then exceptions can be taught. For example, the *Reading Mastery* program begins with teaching the letter-sound correspondence of / a / as in cat. After students have mastered this letter-sound, then exceptions such as / a / as in ape. Third, easy skills are taught first, more difficult skills, second. Finally, skills that are likely to be confused are separated by several lessons. In the example given by Watkins and Slocum, in one DI reading program, the sound / d / is introduced in Lesson 27 whereas the sound / b / is not introduced until lesson 121.

Direct Instruction is well known for some characteristics of teacher-student interactions such as signaling and choral responding. Signaling is a system teachers can use to ensure that all

students respond simultaneously. Simultaneous responding is necessary for group efficiency that ensures that all students have an opportunity to respond. Additionally, teachers can easily hear errors in the group when students respond simultaneously. If students fail to respond at the same time, some students may echo the response of other classmates. Choral responding allows for teachers to maximize the efficiency of active student engagement in group situations. Traditional means of actively engaging students resulted in the teacher asking one question to one student, while the other students in the group fail to participate.

Pacing is another component essential to DI programs. Again, efficiency in active student engagement is the goal as the quicker the pace, the more opportunities students have to respond. According to Watkins and Slocum (2004), brisk pacing has several benefits. First, teachers and students are able to cover more material. Second, appropriate pacing holds student attention. Third, appropriate pacing engages students resulting in a reduction of inappropriate behavior.

Error correction is one of the hallmarks of effective instruction. In order for students to learn most efficiently, errors must be detected and corrected immediately. According to Watkins and Slocum (2004), DI corrects student errors by reteaching and retesting students. This is accomplished by the teacher modeling the correct response, testing the student on the missed item, then retesting the student on the missed item after given several other items.

Finally, teaching to mastery is another component of DI programs. Englemann (1999, as cited in Watkins and Slocum, 2004) recommends that students should reach a mastery of 70% for skills that have been introduced for the first time, 90% for skills previously taught, and 100% for skills at the end of a given lesson.

Research regarding the effectiveness of DI programs has been documented in the literature. Furthermore, the nation's largest educational experiment, *Project Follow Through* 1968–1976, compared different educational approaches to gauge which was best in teaching economically disadvantaged students. Results indicated that DI was by far the most effective model in each of the three areas measured: basic skills, cognitive, and affective measures.

As the importance of reading and reading comprehension have been established, it is alarming that very few studies have investigated the effectiveness of reading interventions for students with ASD. According to O'Conner and Klein (2004), reading instruction for students with ASD has been underemphasized. Furthermore, research has provided ample information regarding effective instructional methods for teaching reading in the general education setting (Shippen, et al., 2010); however, these methods have not been thoroughly examined for students with disabilities, especially those identified as having ASD (Chiang & Lin, 2007).

Direct Instruction Programs for Students with ASD

Research has shown DI to be an effective intervention for students from low socioeconomic backgrounds (Torgesen, et al., 2001), students at-risk for academic failure (Carlson & Francis, 2002; Foorman, Francis, Fletcher, & Schatschneider, 1998; Frederick, Keel, & Neel, 2002; Grossen, 2004; Shippen, Houchins, Steventon, & Sartor, 2005), students with learning disabilities (Swanson, 1998; Torgesen, et al.), students with limited English proficiency (Carlson & Francis), and students with cognitive deficits (Bradford, Shippen, Alberto, Houchins, & Flores, 2006; Flores, Shippen, Alberto & Crowe, 2004; Gersten & Maggs, 1982). In a review of the literature, Whalon and colleagues (2009) reported the effectiveness of code-based instruction for individuals with autism; however, none of the studies included the use of DI

teaching methodologies. Regardless, these authors concluded that individuals with autism are able to develop phonemic awareness and phonic skills regardless of IQ scores.

Despite the newly emerging research involving reading instructional approaches with individuals with autism, a paucity of information exists regarding instructional strategies for teaching reading, especially in regard to the use of DI with this particular population. Of the studies available (four), three have been conducted by the same author and all utilize single subject methodology. Flores and Ganz (2007) investigated the effects of *Corrective Reading* (a DI program) on the reading comprehension skills of four individuals with developmental delays, including autism. Results indicated that a functional relationship existed between DI and reading comprehension and DI. Furthermore, DI was effective in teaching students statement inferences, using facts, and analogies, as all students met criteria in each area.

In another study, Ganz and Flores (2009) investigated the effects of *Language for Learning* (a DI program) on the oral language skills, specifically the identification of materials of which objects are made, for three participants with ASD by utilizing a single subject changing criterion design. Results indicated a functional relationship existed between the program and language as students met criterion with replications over three criterion changes with three students.

Flores and Ganz (2009) investigated the effects of *Corrective Reading* (a DI program) on the reading comprehension skills of three individuals with autism. Using a multiprobe design across behaviors (picture analogies, deductions, and inductions), the authors demonstrated a functional relationship between the DI program and reading comprehension as all participants met the criterion in each of the three areas. Ganz and Flores (2009) found that a DI language intervention program (*Language for Learning*, Engelmann and Osborn, 1999) was a highly

effective intervention for increasing expressive language skills for elementary children with autism. This study employed the use of a single subject changing criterion design. An additional study conducted by these authors in 2007 indicated similar results of a DI program for reading comprehension (*Corrective Reading Thinking Basics: Comprehension Level A*) of students with autism and developmental disabilities.

In a study by Zayac (2009), the author found that the *Reading Mastery Plus* (a DI Program) was effective in teaching children with developmental delays (including children with autism) letter-sound correspondences, blending, segmenting, and word reading. Although a functional relationship could not be determined due to the use of an A-B design, the author concluded that individuals with developmental delays can acquire beginning reading skills using DI. Table 1 provides a summary of the specific research regarding direct instruction for individuals with autism.

Table 1

Recent Research Regarding Students with Autism and Direct Instruction

Study	DI Program	n	Participants	Research Design	Research Purpose	Intervention Details	Outcome Measures	Findings
Flores and Ganz (2009)	Corrective Reading: Comp. A	4	5th and 6th grade Autism, MR, and ADHD	Multi-probe across behavior	Extend DI reading comp research to more complex portions of program	Daily instruction for 20 minutes each day.	Curriculum-based assessment and researcher created probes	Functional relation demonstrated as all students met criterion and no overlap of data
Ganz and Flores (2009)	Language for Learning	3	Elementary students with ASD	Changing criterion	Extend research on the use of DI to the remediation of oral language skills in elementary children with ASD	20 minutes a day, 5 days a week for 3 months	Identification of materials of which objects are made	Functional relationship between DI and oral language skills
Zayac (2009)	Reading Mastery Plus-Level K	5	Preschool students typical, PDD-NOS, and Autism	A-B design	Examine effects of Reading Mastery Plus on preschool students with developmental delays	Instruction 20-25 minutes each day, 3 times per week with extended periods of non-instructional days occurring throughout the study	% correct responding on letter-sound correspondence, say it fast, say the sounds, say the sounds-say it fast, sounding it out, and reading vocabulary	Students with developmental delays are able to acquire beginning reading skills
Flores and Ganz (2007)	Corrective Reading Thinking Basics A	4	5th and 6th graders with Autism, MMR, and ADHD	Multiple-probe across behaviors	Investigate the extent to which DI could be implemented with students with ASD and the effectiveness of this program for these students	20 minutes per day, 5 days per week	Statement inferences, using facts, and analogies	Functional relationship between DI and reading comprehension demonstrated

A study completed by Fallon and colleagues (2004), demonstrated the effectiveness of a DI on single word reading skills for children with severe speech impairments who require augmentative and alternative communication (AAC). In a single subject, multi-probe across five participants design, all five participants reached criterion for matching targeted words to corresponding pictures, while three of the five generalized the skills to novel word reading and four of the five participants generalized reading skills to book contexts.

This study was included in the literature review because approximately half of individuals with autism fail to develop functional communication (Bryson, Clarke, & Smith, 1988; NRC, 2001). As a result, AAC is often used for these individuals, and implications from this study are relevant her e. According to Fallon and colleagues (2004), individuals who require AAC present many unique challenges in designing effective reading instruction, because (a) they cannot use natural speech to sound out words and receive articulatory feedback, (b) they may have a limited experiential base to support the learning process, (c) they may not have the receptive language base necessary for comprehending written language, and (d) instructors may have significant difficulty observing and evaluating reading skill development given the students' inability to respond orally (e.g., reading aloud, repeating sounds). However, teaching strategies may need to be significantly adapted to meet the needs of these individuals. "The reading instruction tasks must adhere to established teaching principles, yet compensate for the limited speaking capabilities that preclude individuals who use AAC from responding orally to training tasks" (Fallon et al, 2004, p. 1426).

Similarities between ABA and DI

Given the established effectiveness of ABA for individuals, coupled with the emerging evidence of the effectiveness of DI for students with autism, it is worthwhile to examine the

similarities between these two techniques. Perhaps the most important similarity is that behaviorism serves as the foundation for each of these approaches. The focus of ABA and DI is improving learning through measurable changes in individual behavior. Furthermore, this change in behavior is achieved by shaping behavior(s) through reinforcement, with the ABA view of reinforcement being much more stringent than that of DI.

In addition to the theoretical framework for these approaches, both techniques target practical, socially valid skills for instruction. The skills selected for instruction are based upon areas of weakness and/or need as determined by assessment. Instructional needs are then operationally defined as specific and measurable behaviors. This is achieved through systematic observation and recording of behavior. DI programs also allow for individuals to observe and record their own behavior(s).

ABA and DI instructional approaches both consist of stimulus control in that an individual's behavior is controlled by a stimulus. Teachers or instructors provide a stimulus for student behavior to occur. On-task behavior is maximized through frequent teacher/student interactions, and students are given multiple opportunities to respond and/or practice a given skill. The probability of correct student responses is maximized through task analysis and chaining of behaviors as well as positive reinforcement/praise for effort and/or correct responses. Teaching to mastery is an important component of both techniques; reinforcement and prompting are eventually faded. Another important component of both techniques is for students to be able to generalize skills to other settings.

Summary

Autism is a complex neurological disorder that manifests itself in a wide array of symptomology. Legislation such as IDEA and NCLB require schools to educate these students

in the least restrictive environment with access to scientifically based instruction in order to ensure a FAPE. Although the majority of scientific research regarding effective educational interventions for this population focus on improving communication, social skills, and functional skills, there is a significant need to examine instructional strategies aimed at teaching reading skills to this population. Direct instruction is one technique which possesses evidence based for effectiveness and efficacy and has been shown to be effective for variety of diverse groups of student populations (Bradford et al., 2006; Carlson & Francis, 2002; Flores et al., 2004; Foorman, Francis, Fletcher, & Schatschneider, 1998; Frederick, Keel, & Neel, 2002; Gersten & Maggs, 1982; Grossen, 2004; Shippen, Houchins, Calhoon, Furlow, & Sartor, 2006; Shippen et al., 2005; Swanson, 1998; Torgesen et al.); however, Joseph and Seery (2004) argue that students with cognitive deficits are ignored in the explicit phonics instruction literature. Additionally, DI has been shown to be effective with students who demonstrate development delays (Flores & Ganz, 2007, 2009; Ganz & Flores, 2009; Zayac, 2008). Clearly, more empirical evidence is warranted to identify DI as a validated method for teaching reading to children with ASD.

CHAPTER III. METHODOLOGY

Participants

Participants included in this study were from a small rural school system in the southeast United States. Participants were chosen based on a previous diagnosis of autism or intellectual disability and a need for targeted instruction in the area of reading comprehension. Three students met inclusion criteria. Two of the students received special education services due to eligibility in the area of autism and one student received special education services due to specific learning disability; however, this student had an I.Q. in the intellectual disability range as well as motor and adaptive behavior deficits and had received services under the label of developmental delay until she was nine years old. All three students exhibited weaknesses in the area of reading comprehension as indicated by a reading comprehension goal in his/her IEP and difficulty with reading comprehension achievement as demonstrated by a standard score below 85 on reading comprehension portions of the Woodcock Reading Mastery Tests-Third Edition (WRMT-III; Woodcock, 2011). Since students with autism demonstrate unique characteristics in regard to IQ (Mayes & Calhoun, 2003; Rumsey, 1992) and reading achievement (Nation, Clarke, Wright, & Williams, 2006; Tager-Flusberg, Paul, & Lord, 2005), detailed information in these areas is provided. Demographic information is provided in Tables 2 and 3.

Table 2

Participant Demographic Information

Student	Age	Ethnicity	Grade Level	Disability	F/R Lunch	Years in SpEd	I.Q.*
Jon	10	W	5	Autism	Yes	6	82
Mia	14	AA*	8	ID****	Yes	8	62
Tim	16	W***	10	Autism	Yes	10	64

*As measured by the KBIT-2

**African American

***White

****Intellectual Disability

Table 3

Standard Scores for IQ and Reading

Student	FS IQ*	Verbal IQ	Nonverbal IQ	Basic Skills	Reading Comp	Total Reading
Jon	82	63	106	90	73	82
Mia	62	80	54	55	55	55
Tim	64	68	70	78	55	67

*Full Scale

The first participant, Jon, was a 10-year-old boy in the 5th grade who had a diagnosis of autism. He was diagnosed by a developmental pediatrician at the age of 3; however, no specific testing information regarding this diagnosis was included in the doctor's report. In order to determine eligibility under IDEA, a school psychologist conducted another, separate

comprehensive evaluation and also diagnosed Jon as having autism. The diagnosis was partially based upon scores obtained on the Childhood Autism Rating Scale (CARS) which yielded an overall autism index score of 89 indicating very likely probability of autism. IQ testing administered by this researcher yielded similar results to prior testing. Jon obtained a full scale IQ of 82 on the Kaufman Brief Intelligence Test, Second Edition (KBIT-2; Kaufman & Kaufman, 2004); however, it is the opinion of this researcher that his IQ might be slightly higher as Jon seemed to tire and began guessing on items toward the end of testing. His performance on IQ subtests is consistent with prior research indicating that younger individuals with autism often score higher on nonverbal portions of IQ tests. Performance on reading subtests of the WRMT-III are also consistent with prior research in that he performed significantly better on the basic skills subtest as opposed to the comprehension subtest.

The second participant, Mia, was a 14-year-old girl in the 8th grade who exhibited significant delays in adaptive behavior, motor, and cognition and had received services for developmental delay since three years of age. Prior to receiving special education services from the public school, she received early intervention services through a state funded early intervention program. Motor deficits resulted in difficulty walking which she wore braces on her legs for support. This also had an impact on her handwriting. Although her handwriting was very neat, motor deficits required a longer amount of time for Mia to complete assignments. Her delays are consistent with a diagnosis of cerebral palsy although this information was not available to this researcher. Mia's score on the KBIT-2 indicated significantly below average intellectual ability. Reading achievement indicated significant deficits in both decoding and comprehension. Since the WRMT-III truncates at a score of 55, Mia's actual reading

achievement might actually be lower than reported. To help address this, grade equivalents were also reported.

The third participant, Tim, was a 16-year-old boy in the 10th grade who was receiving special education services due to a diagnosis of autism. Tim had received speech services due to language delay as well as special education services for emotional and behavioral disorder since preschool. He was also diagnosed as having "ADHD mixed R/O PDD" (Rule-out Pervasive Developmental Disorder). In 2008, Tim began receiving services for autism rather than emotional and behavioral disorder after being diagnosed as having high functioning autism by a licensed psychologist. He scored in the mild to moderate autistic range on the CARS and was diagnosed as having high functioning autism with ADHD combined type. Tim's reading scores are consistent with the literature base in that basic skills are significantly higher than comprehension skills.

Setting

The study was conducted in a public middle school general education classroom, within a small rural school district in the southeast United States. The school system was composed of one elementary, one middle, and one high school. The middle school was comprised of 579 students in grades 4–8 and the high school was comprised of 462 students in grades 9–12. Both schools were Title I schools with 73 percent of the middle schools' students receiving free and reduced lunches and 63 percent of the high school receiving free and reduced lunches. Forty-four percent of the middle school students were African American and 52 percent were white. Forty percent of the high school population was African American and 57 percent was white.

Materials

Materials used for this study included the reading comprehension program, *Corrective Reading Comprehension: B1* (Engelmann, Osborne, & Hanner, 2008). This consisted of a teacher's guide, scripted teacher presentation book, and student workbook. The program is divided into separate strands of skills with several components in each strand. Each lesson contains instruction regarding multiple strands. Strands of skills include (a) reasoning skills, (b) information skills, (c) vocabulary skills, (d) sentence skills, (e) basic comprehension skills, and (f) writing skills. See Appendix A for skills taught in *Corrective Reading Comprehension: B1*.

In addition to the reading program, probes for each dependent variable were created by the researcher. Examples of researcher created probes for each skill are included in Appendixes B-E. The KBIT-2 was used to assess intellectual functioning and curriculum-based measures of reading comprehension were obtained using the maze subtests of AIMSWeb.com. The WRMT-III was used to assess current levels of reading comprehension as well as to measure comprehension growth.

Experimental Design

A single subject multiple-probe across behaviors design was used to determine whether a functional relation existed between a DI comprehension program and the percentage of items correct on probes. The multiple-probe design is a variation of the multiple baseline design, in that participants are probed intermittently (rather than continuously) during baseline periods. According to Horner and Baer (1978), the application of multiple-probe design is appropriate when measurement during extended baselines (a) may prove reactive, (b) is impractical, (c) and/or a strong *a priori* assumption of stability can be made. Since the analysis involving behaviors within the parts of speech tract is analogous to a successive approximation sequence in

that it would be impossible for a student to identify nouns and verbs if he/she cannot identify verbs, the multiple-probe approach is most appropriate. Also, given anticipated extended baseline periods as well as the length of time required to give some probes, it was impractical to administer continuous baseline procedures.

Skills within the DI program were chosen as dependent measures based on previously identified deficit areas. The deficit areas were determined based on results from each student's performance on the pretest included in the *Corrective Reading* program as well as researcher observation regarding weaknesses of each student. Each student was observed under two separate, independent experimental analyses. In other words, each student had two multiple-probe across behaviors studies occurring simultaneously as he/she progressed through the reading program. The first experimental analysis involved parts of speech. The specific behaviors observed were identifying (a) verbs, (b) nouns and verbs, (c) adjectives, nouns, and verbs and (d) articles, adjectives, nouns, and verbs. Each of these behaviors was a component of the parts of speech tract which fell under the sentence skills strand.

The second experimental analysis involved examination of behaviors across strands of sentence skills and reasoning skills. The specific behavioral tracts from these skills were combining sentences with and, identifying contradictions, and identifying relevant/irrelevant statements. Due to an unstable baseline for combining sentences with and, Tim was observed for an additional behavior of combining sentences with which.

During baseline phase, stability was determined by a minimum of three data points with no upward trend. Additionally, the last three data points were to indicate no more than 10% variance of the mean rate of responding. Although stability of baseline was not established for verbs for Mia and Tim as well as combining sentences with and for Tim, due to time constraints

this data were collected and reported nonetheless and an additional behavior was added to the analysis.

Once stability was achieved, instruction based on the *Corrective Reading Comprehension: B1* program began with each student. During this time the other two behaviors remained in baseline. Once the student reached 90% or better on three consecutive probes, instruction began on the second behavior. After the student met the 90% criterion on three consecutive probes for the second behavior, instruction began with the third behavior. One month after instruction ended, a maintenance probe was administered for each skill.

Generalization measures were administered to each student in order to determine if students were able to generalize skills taught and mastered in this reading program to other classroom tasks. Generalization measures consisted of pre and posttest measures from maze subtests from AIMSWeb, which is a commonly used curriculum-based assessment to measure reading comprehension. Due to variability within the maze subtests, students were administered three tests independently of one another, and the mean number correct was reported.

Independent and Dependent Variables

The independent variable consisted of the reading comprehension program, *Corrective Reading Comprehension: B1* (Engelmann, Osborn, & Horner 2008). This program consists of 60 lessons and is designed for students in grades 4–12 who struggle with comprehension. Since reading comprehension is a complex task with many components, this program consists of several strands of skills necessary for successful comprehension. The strands of skills are reasoning skills, information skills, vocabulary skills, sentence analysis skills, basic comprehension skills, and writing skills. Each lesson is comprised of multiple tracts. For example, Lesson 11 contains definitions (vocabulary skills), deductions (reasoning skills),

inference (basic comprehension skills), and body systems (information skills). The workbook contains parts of speech (sentence skills), following directions (basic comprehension skills), definitions (vocabulary skills), classification (information skills), and writing stories (writing skills). In addition, each tract is comprised of several different objectives which increase in complexity as the program progresses. For instance, in the parts of speech tract the student is required to identify nouns in Lesson 3, then identify nouns and verbs in Lesson 6, and nouns, verbs, and adjectives in Lesson 14. For this reason, the *Corrective Reading* program dictated the order in which data regarding the observed skills were collected.

The dependent variables chosen for this study were based on previously identified deficit areas as measured by the pretest contained in the *Corrective Reading* program as well as researcher observation regarding weaknesses of the students. The specific skills selected for analysis in this study were (a) verbs, (b) verbs and nouns, (c) verbs, nouns and adjectives, (d) verbs, nouns, adjectives and article contained in the parts of speech strand. A second analysis involved sentence combinations, contradictions, and relevant/irrelevant information found in sentence skills and reasoning skills. The dependent variables consist of researcher created probes which are modeled after the skills and behaviors presented in the *Comprehension:B1* program. Directions were provided for each probe, and sample probes are provided in Appendixes B-E. Skills and behaviors used for analysis are discussed in depth below.

Sentence skills. According to the Engelmann, Osborne, and Hanner (2008), students with a poor understanding of sentence structure have difficulty comprehending complicated textbook sentences. Two components of this study are found within the sentence skills domain. An entire multiple-probe analysis is devoted to the parts of speech track and is discussed below.

Also, sentence combinations are included as a behavior of analysis in the second multiple-probe analysis.

Parts of speech. The parts of speech track requires students to identify nouns, verbs, adjectives, and articles and are introduced in the context of regular order sentences. Students are also taught to examine sentence structure. Lesson 1 begins with teaching that sentences have two parts (subject and predicate). Identification of verbs is the first behavior analyzed and first appears in Lesson 6. Nouns are first introduced in Lesson 10 and adjectives first appear in Lesson 13. Articles first appear in Lesson 50.

Sentence combinations. Several different formats exist within the sentence combination tract. The format included for analysis here is combining sentences with and (same). This tract requires students to combine two sentences into one sentence by using the conjunction and. For example, in Lesson 22 a student is required to combine the following, "Ron had pens. Ron had tops." into one sentence of "Ron had pens and tops." In order to receive credit within the program and for scoring probes, the student must ensure that subject and verb agree. For example: "Ron was running. Pam was running." had to be combined as "Ron and Pam were running."

Contradictions. The contradiction tract teaches students how to recognize contradictions and to analyze flaws in passages. Four formats are found in the contradictions tract. The format included in the analysis for this study began in Lesson 32 and required the student to identify contradictions of a given fact. In subsequent lessons, the student is required to identify the contradiction(s) and to correct it to make it true, modify statements to make them synonymous, and identify which of two facts a statement contradicts. An example of a contradiction skill is as follows:

Fact: Sam is taller than Bill

Statement 1: Sam is shorter than Bill. (contradiction)

Statement 2: Bill is shorter that Sam. (not a contradiction)

Relevant/Irrelevant. Identifying relevant/irrelevant statements is part of the evidence tract found within reasoning skills strand and is first introduced in Lesson 46. Specifically, students are required to indicate whether facts are relevant or irrelevant to an outcome. An example of this skill can be found in Appendix E.

Additional variables were scores on the reading comprehension cluster and total reading scales of the WRMT-III. These subtests align with the skills that are taught in *Comprehension: B1*. Forms A and B were administered as pre and posttests respectively. The WRMT-III is a standardized test of reading that measures reading achievement and provides grade and age based norms. The WRMT-III yields quotient scores with a mean of 100 and a standard deviation of 15. The reading comprehension cluster consists of word comprehension (antonyms, synonyms, and analogies) and passage comprehension (identifying a missing word in a passage). These scores contribute to the total reading composite, which is a combination of word identification, word attack, word comprehension, passage comprehension, and oral reading fluency. The total reading composite serves as a measure of global reading ability. Gains in reading comprehension and generalization to standardized measure were assessed through administration of these reading components.

Procedures

Prior to initiation of this study, permission from Auburn University IRB was obtained. Once permission to conduct the study was granted, parents were contacted in writing, informing them of the opportunity for their child to participate in the study. The letter included the purpose

of the study, which was to improve reading comprehension skills. A consent form was included with the letter and provided information about the criteria for participation. Once parental consent was obtained, each student was asked to provide a minor assent. The researcher read the assent to the participant. After reading the assent, the researcher asked the participants to sign the assent form.

In order to determine whether each student met study requirements, several assessments were given. Initially, the researcher examined each student's IEP to determine if he/she had a goal related to reading comprehension. Secondly, the researcher confirmed each student's special education eligibility status as being either autism or developmental delay. The KBIT-2 was administered to describe the student's level of intellectual functioning. The WRMT-III was administered to assess current reading achievement levels. The placement test found within the Direct Instruction program, *Corrective Reading Thinking Basics*, was also administered to determine where instruction should begin. All three students tested into the *Comprehension: B1* level.

After initial assessments had been administered, baseline data were collected until the student demonstrated consistent performance on a minimum of three probes. Stability was defined as no more than 10% variance from the mean rate of responding. Once baseline was established, instruction began with Lesson 1 in the *Corrective Reading Comprehension: B1* program. Instruction for two of the participants, Jon and Mia, consisted of 2 instructional sessions per day, lasting approximately 30 minutes per session, and occurred 5 days per week for approximately six weeks. For the third participant, Tim, instruction was delivered after school. This researcher carried out the instructional sessions in one-on-one format. Once student achieved mastery (90% or better on three consecutive probes) of the identified skill, instruction

began for the second identified deficit skill. Introduction of skills were dictated by the order in which they appeared in the reading program.

Once the study was completed, the WRMT-III was administered to the students in order to describe progress in reading comprehension. The maze subtest of AIMSWeb curriculum-based assessments was administered to determine if students were able to generalize reading comprehension skills to classroom tasks. Additionally, a maintenance probe was given one month post intervention.

Placement and Pretesting

The researcher administered the placement test for the *Corrective Reading Comprehension* program. Participants were also given the WRMT-III to assess pre-intervention reading comprehension skills. A curriculum-based reading comprehension measure from AIMSWeb was administered based on each student's current grade level (according to WRMT-III).

Baseline Procedures

During baseline, participants were given probes for each of the behaviors observed and were instructed to follow the directions to complete the assignment. Probes were then scored and participants did not receive feedback on these probes during baseline or intervention. Once baseline was established, participants began intervention with *Corrective Reading Comprehension: B1*.

Intervention Phase

Once baseline was established, intervention began with lesson 1 in the *Corrective Reading* program; however the first skill observed in the analysis was not introduced until lesson 6. The participants received instruction individually. Instruction for two participants took place

in the morning during which the participants were enrolled in PE. Instruction for the third participant took place in the afternoon, during an after school program. Instruction was delivered to each participant individually and the researcher presented instruction by following the script and procedures in the program's teacher presentation book. She had 15 years experience teaching, including eight years as a special education teacher. She had extensive experience using DI programs; however, this was her first time to use the level B1 program.

During instruction each lesson lasted approximately 30 minutes and two lessons were delivered per day as time permitted. Portions of some lessons for the second and third participants were repeated as was necessary to master certain skills and as prescribed by *Corrective Reading* program. In other words, it took these participants longer to master certain skills than others, so additional time was spent practicing those skills. For the first analysis, verbs were first introduced in lesson 6, nouns in the subject were introduced in lesson 2; however identifying all nouns in a sentence was introduced in lesson 9, adjectives were first introduced in lesson 13, and articles were first introduced in lesson 50. For the second analysis, combining sentences with and (same), begins in lesson 22, identifying contradiction begins in lesson 32, and identifying relevant/irrelevant statements began in lesson 46.

Prior to instruction, students were given a pencil and workbook. Daily instruction was provided by this researcher and was delivered by following the script provided in the teacher's presentation book. Instruction included verbal introduction of skills as well as teacher modeling of skills. The teacher also provided guided practice with students and then students were required to perform skills independently without the instructor. Error correction was provided immediately as described in the presentation book which included: (a) modeling the correct

response; (b) leading the students in the correct response; (c) and asking the students to respond independently. All parts of the reading program were implemented without modification.

Post Testing

Participants were administered the WRMT-III upon completion of the B1 level of *Corrective Reading Comprehension*. In addition, each participant was administered three separate maze portions of AIMSWeb curriculum based probes. Each probe was selected based upon student's performance/ grade level according to the WRMT-III and was timed. The mean number of items correct was reported.

Scoring Procedures

The researcher calculated the percent correct on probes and graphed the data. Each item was scored as either correct or incorrect. Approximately 20% of the probes were checked for interobserver reliability. A special education teacher with a master's degree and ten years teaching experience completed the reliability. Agreement was calculated on an item by item basis by dividing the number of agreements by the total number agreements and disagreements and multiplying by 100 (e.g., 8 agreements ÷ 10 total agreements/disagreements X 100 = 80% agreement).

Maintenance and Generalization Procedures

Maintenance probes were administered to determine if participants maintained comprehension skills over time. Participants were given maintenance probes approximately one month after the conclusion of the intervention. One purpose of this study was to determine if students were able to generalize comprehension skills to other tasks commonly found in the classroom. In order to ascertain whether students were able to generalized newly acquired skills, students were asked to complete tasks similar to those in the *Corrective Reading* program that

are normally part of the general or special education classroom. This was done through pre/post analysis of performance on curriculum based measures for reading comprehension on AIMSWeb probes.

Probes

In order to avoid potential threats to interval validity (mainly the effects of test/retest), five ten-item assessments from a pool of 30 probes for each skill/behavior of interest was created by this researcher. These items were based on instruction from the DI comprehension program and modeled based on the format and language used within the program.

Reliability of the probes was assessed by distributing the instrument to 25 eighth grade students. After completion, each was scored as either correct or incorrect. Split-half reliability was utilized using SPSS to determine reliability of the instrument. A Cronbach Alpha of .8 or better was required as results within this range indicate good ($\alpha > 0.8$) or excellent ($\alpha > 0.9$) internal consistency. Reliability tests were conducted for each skill area of analysis and yielded a Cronbach's Alpha Coefficient of $r = 0.93$ for verbs, $r = 0.92$ for nouns, $r = 0.86$ for adjectives, and $r = 0.97$ for articles. For the second analysis of across strands, Cronbach Coefficient Alpha yielded $r = 0.91$ for contradictions, $r = 0.93$ for relevant/irrelevant, $r = 0.86$ for same.

Treatment Fidelity/Interobserver Agreement

Treatment fidelity was measured using a checklist of instructional procedures (Marchand-Martella, et al., 1995; see Appendix D). Approximately 20% of instructional sessions were checked through direct observation or videotape. The checklist was completed by a teacher with a master's degree in special education with ten years of teaching experience and experience using DI programs. Treatment fidelity observations were carried out with 100% accuracy for 100% of the observed sessions. Assessment of treatment fidelity occurred periodically

throughout the study. Interobserver agreement was calculated for each treatment fidelity sessions. Agreement of 100% or better was obtained and was calculated by dividing the total number of agreements by the total agreements and disagreements and multiplying by 100.

Content Validity

A content validity analysis was conducted by three master teachers in the field of reading. The master teachers rated each area (verbs, nouns, adjectives, articles, same, relevant, and contradictions) as relevant, somewhat relevant, or irrelevant. Items were assigned a Likert scale from 1 to 3 with 1 being relevant, 2 being somewhat relevant, and 3 being irrelevant. The mean score for parts of speech and same were 2.3 indicating these skills were most likely relevant to reading comprehension. For relevant and contradiction skills, a mean of 3 was obtained indicating that these skills were relevant to reading comprehension.

Social Validity

Social validity data from the student and student's teacher were collected at the conclusion of the intervention. Each individual was asked questions regarding opinions regarding the efficacy, importance, and usefulness of this intervention. See Appendixes G-H for social validity checklists.

Data Analysis

Data were collected through event recording by using 10 item probes for each dependent measure. Each item on each probe was scored either correct or incorrect. The data were graphed for baseline and intervention phases and then analyzed through visual inspection of the graph(s) across behaviors. In the baseline phase, a minimum of three data points were required with no more than 10% variance among the mean of the last three data points. Points of emphasis were the percentage of non-overlapping data between baseline and intervention phases (Scruggs &

Mastropieri, 1998), immediacy of the effect of the intervention once implemented, level between phases, and the number of data points to criterion. A Tau-U statistic was also calculated to describe effect size. Scores on WRMT-III and maze subtests of AIMSWEB.com were also reported to describe generalization to standardized tests and curriculum based measures of reading comprehension achievement.

CHAPTER IV. RESULTS

Introduction

In order to determine the effects of a Direct Instruction reading comprehension program, *Corrective Reading Comprehension: B1*, on students' acquisition of comprehension skills, the percent correct items on probes were graphed and analyzed. Each student's behaviors were observed in two separate analyses. The first analysis examined the percent correct on the parts of speech strand. Specifically, the student was required to identify (a) verbs, (b) nouns and verbs (c) adjectives, nouns, and verbs, (d) and articles, adjective, nouns, and verbs. The acquisition of the skills/behaviors observed in this analysis was considered a successive approximation as the student would not be able to identify verbs and nouns if he/she could not identify verbs.

The second analysis examined skills across strands of reading skills. These probes specifically consisted of same, contradictions, same 2 (for the last participant) and relevant skills. The same skill was a component of the sentence skills strand and required students to identify parts of sentences that were the same, then combine the two sentences with the conjunction 'and'. In order to receive credit, the verb had to agree in number with the subject. The contradiction skill was a component of the reasoning strand and required students to identify which statement(s) contradicted a given statement. The same 2 skill required the student to combine two sentences with 'which'. The last skill (relevant) was a component of reasoning

skills and required students to determine which statement(s) were relevant to a given statement. Examples of each skill can be found in Appendix F.

In addition to examining the effects of the DI reading program on specific reading comprehension skills, a goal of this study was to determine if increases in reading comprehension generalized to standardized measures of reading comprehension. In order to address this research question, pre and posttest scores for each student were analyzed using the WRMT-III. Participants were administered all portions of the WRMT-III. Also, each participant was administered three pre and posttest AIMSWeb maze probes, and the mean number of items correct was reported.

Baseline Data

Before intervention began, each student was administered baseline probes. Jon's baseline data were stable across all behaviors with zero percent correct problems on all probes. Mia's baseline performance was also stable across all behaviors except for that of identifying verbs; therefore, these data were included but an additional behavior was added in order to determine whether a functional relation existed. Tim's baseline performance was stable across all behaviors except verbs and same; therefore an additional behavior was added to the analysis. Once stability was determined for each student, this researcher began the intervention which was the reading program *Corrective Reading Comprehension: B1*.

Baseline mean performance for Jon was zero for all behaviors. Baseline mean performance for Mia was zero for all behaviors except verbs, which was 15 percent. Baseline mean performance for Tim was zero for all behaviors except verbs (57 percent), same (7 percent), and relevant (30 percent).

Performance After Instruction

Jon. For the within strand analysis which required the participant to identify parts of speech, Jon reached criterion for identification of verbs after three sessions (90% or better for three consecutive probes). The mean level of performance was 93 percent with a +9 change in level of performance and a mean difference of 93 percent between baseline and intervention phases. For the second behavior of nouns and verbs, Jon reached criterion after five sessions. The mean level of performance was 86 percent with a +6 change in level of performance and a mean difference of 86 percent between baseline and intervention levels. For the third behavior of adjectives, nouns, and verbs, Jon reached criterion after four sessions. The mean level of performance was 88 percent with a+7 change in level of performance and a mean difference of 88 percent between baseline and intervention phases. Finally, the last behavior which required the student to identify articles, adjectives, nouns, and verbs, Jon reached criterion after 3 data points. The mean level of performance was 100 percent with a +10 change in level of performance and a 100 percent mean difference between baseline and intervention phases. See Figure 1 for Jon's performance on the parts of speech strand.

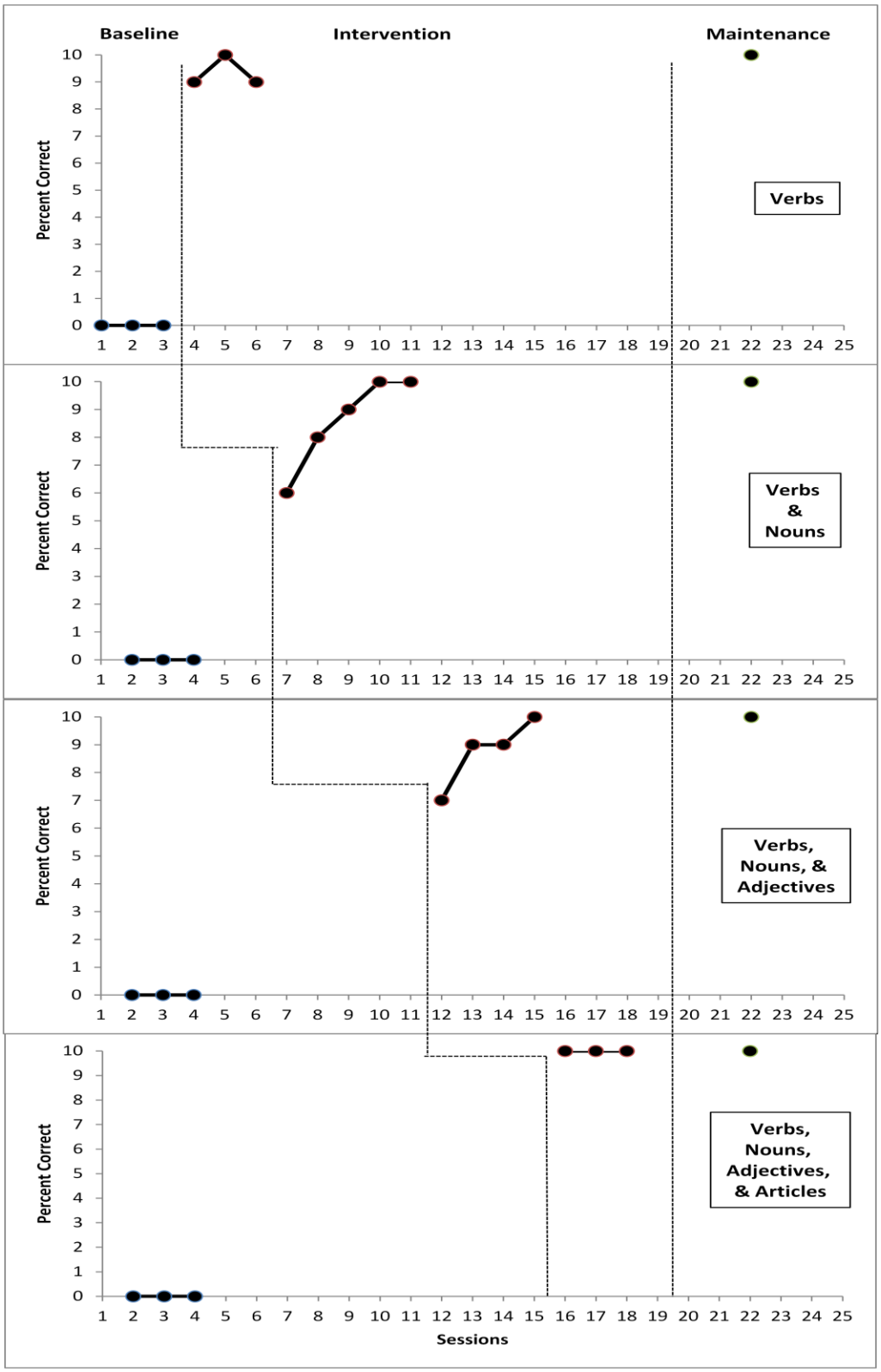

Figure 1. Jon's Performance on Parts of Speech Strand

In addition to visual analysis of the graphed data, the percentage of non-overlap data points was calculated and indicated 100% of non-overlapping data. Results from the Tau-U statistic was significant, $p < 0.00$ with an effect size for four phase contrasts as ES = 1 and a confidence interval of CI_{95}= 0.52 – 1.47 indicating moderate to large academic benefits from the DI reading program.

For the second analysis of skills across strands, Jon reached criterion for same after three sessions. The level of performance was 97 percent with a +9 change in level of performance and a mean difference of 97 percent between baseline and intervention means. Jon reached criterion for the second behavior (contradictions) after three sessions. The level of performance was 90 percent with an immediate change in level of +9 and a mean difference of 90 percent between baseline and intervention phases. For the third behavior, Jon reached criterion after 4 sessions. The level of performance was 85 percent with a +7 change in level of performance with an 85 percent difference in baseline and intervention phases. See Figure 2 for Jon's performance on across strands skills.

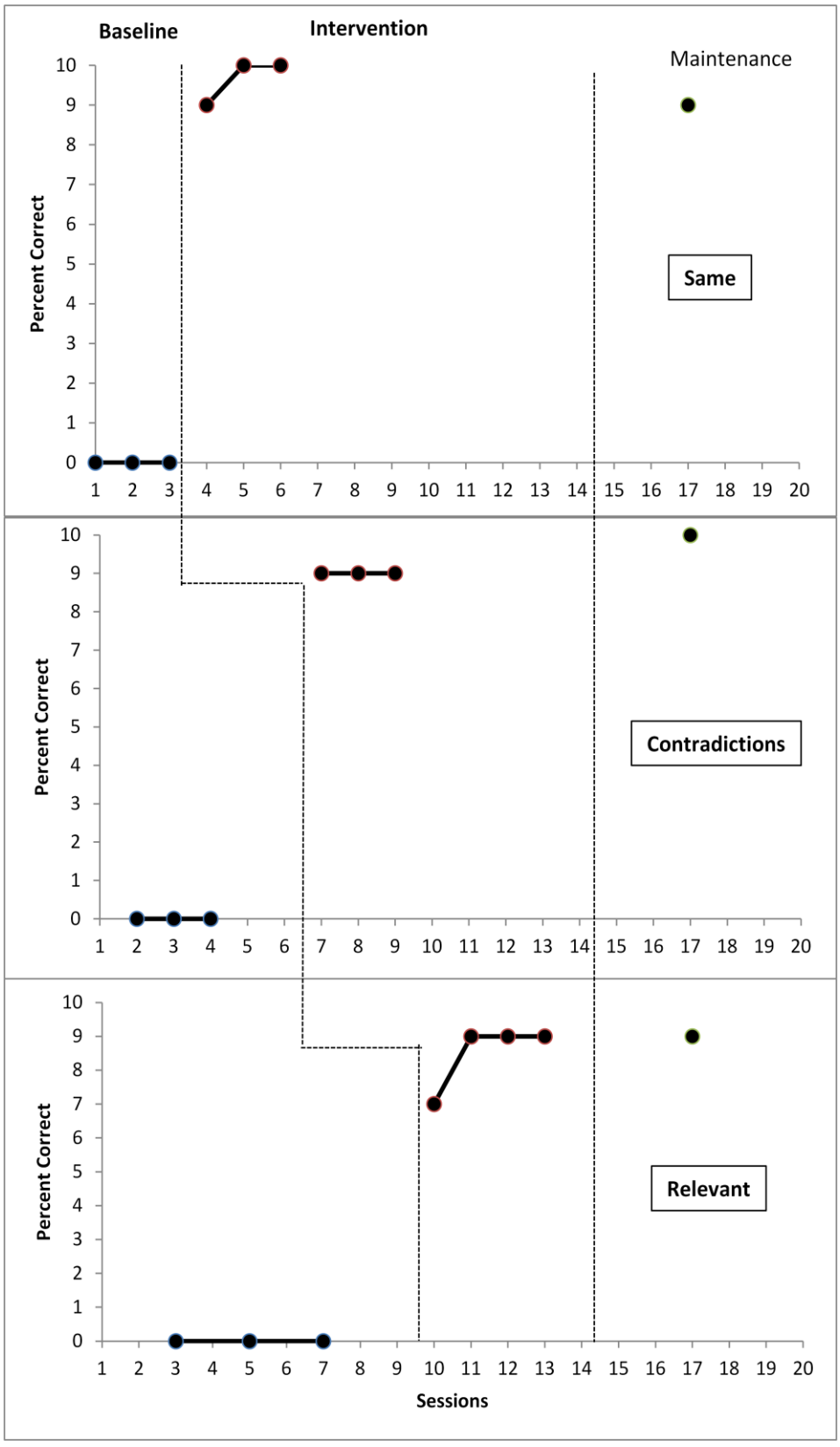

Figure 2. Jon's Performance on Across Skills Strand

In addition to visual analysis of the graphed data, percentage of non-overlap data points was calculated and resulted in 100% of non-overlapping data. Results from the Tau-U statistic was significant with $p < 0.00$ and an effect size for three phase contrasts of ES = 1 and a confidence interval $CI_{95} = 0.43 – 1.56$, indicating moderate to large academic benefits from the DI reading program.

Pre and posttest scores on the WRMT-III indicated generalization of reading comprehension skills to standardized measures of reading. These scores as well as net gain for both standard scores and grade equivalents are reported in Table 4.

Table 4

Standard Scores and Grade Equivalents for Jon's Pre/Posttest

WRMT-III Subtest	Pretest Scores	Posttest Scores	Net Change
Word Comp	84 (2.9)	86 (4.0)	+2 (+1.1)
Passage Comp	65 (1.7)	94 (4.3)	+29 (+2.6)
Reading Comp	73(2.2)	90 (4.2)	+17 (+2.0)
Total Reading	82(2.8)	85 (3.6)	+3 (+0.8)

Mia. For the parts of speech analysis, Mia reached criterion for identification of verbs after twelve probes (90% or better after three consecutive probes), and the average level of performance was 70 percent. There was -2 change in performance level and overlap existed for two of the data points; however, the data points continued in an upward trend throughout the intervention and the mean difference between baseline and intervention was 59.5 percent. For

the second behavior in the parts of speech analysis, Mia reached criterion after seven probes, and the average level of performance was 73 percent. An immediate change in performance level of +5 existed with no overlap and an upward trend in intervention. The mean difference between baseline and intervention phases was 73 percent. Mia reached criterion for the third behavior after eight probes with an average level of performance of 78 percent. There was also an immediate change in performance of +4 with no overlap and a mean difference of 78 percent correct between baseline and intervention phases. Mia reached criterion for the last behavior after three probes and the average level of performance was 100 percent. An immediate change in performance level of +10 existed with no overlap with a mean difference between baseline and intervention phases of 100 percent. Results of Mia's performance on the parts of speech strand are shown in Figure 3.

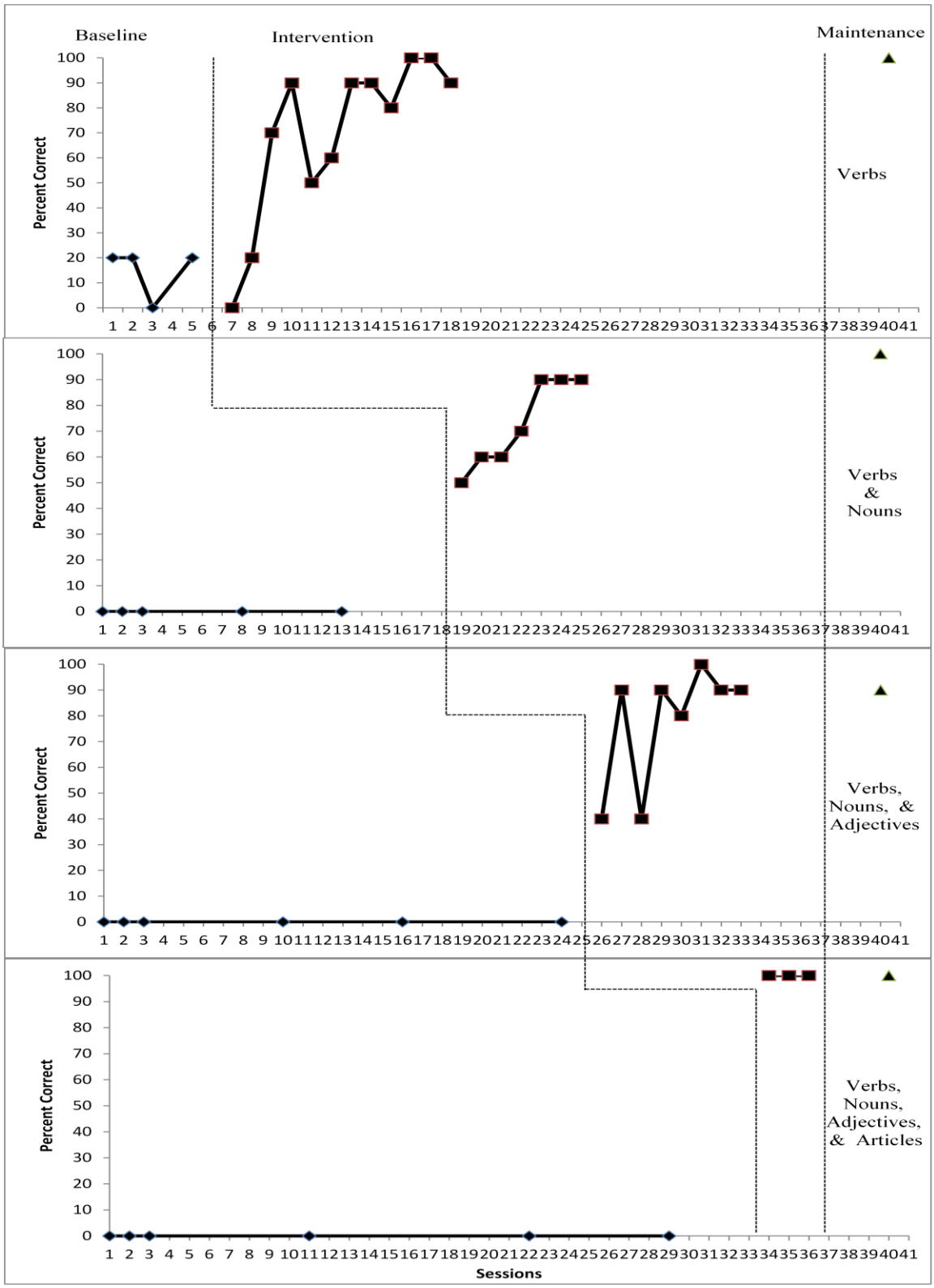

Figure 3. Mia's Performance on Parts of Speech Strand.

In addition to visual analysis of the graphed data, the percentage of non-overlap data points was calculated and indicated 93 percent of non-overlapping data. A Tau-U statistic was also calculated in order to describe effect size. This yielded a p value of $p < 0.00$; ES = .95; CI_{95} = 0.59 – 1.3, indicating moderate to large academic benefits from the DI reading program.

For the analysis of across strands within the *Corrective Reading Comprehension: B1* program, Mia reached criterion for the first behavior (same), after nine probes, and an average level of performance of 78 percent. There was no change in level of performance and overlap existed for one data point; however, the data points continued in an upward trend in intervention phase and the mean difference between baseline and intervention was 78 percent. For the second behavior (contradictions), the average level of performance was 82 percent. There was an immediate change in level of performance of +2 with no overlap of data and a mean difference between baseline and intervention phases of 82 percent. For the third behavior (relevant), the average level of performance was 74 percent. There was a change in level of performance of +2 with no overlap. The mean difference between baseline and intervention phases was 74 percent. The percentage of non-overlapping data points was 95.5 percent. See Figure 4 for Mia's performance on across strands skills.

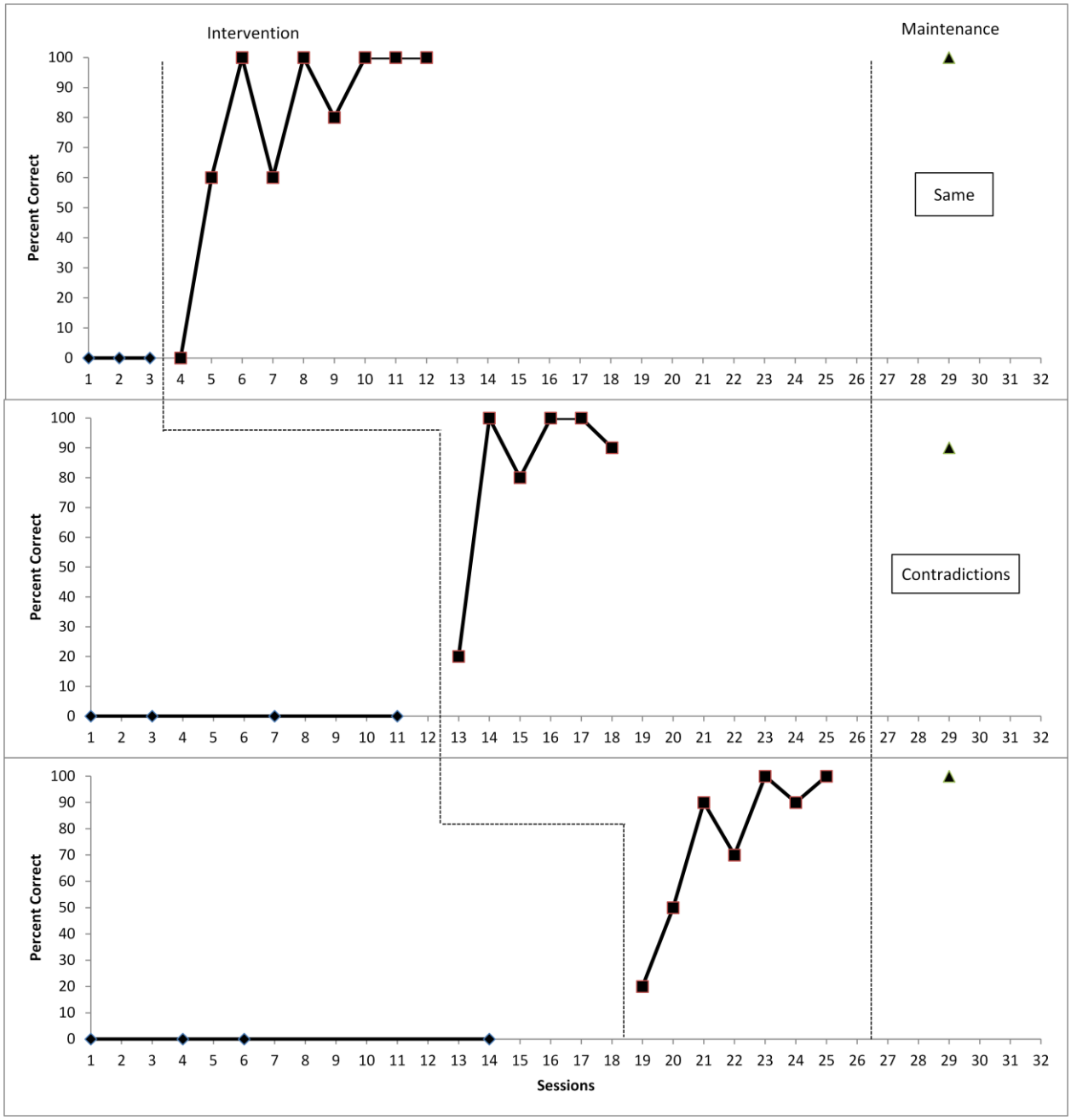

Figure 4. Mia's performance on Across Strands Skills.

The Tau-U statistic yielded $p < 0.00$; ES = .96; CI_{95} = 0.52 – 1.4 indicating moderate to large academic benefits from the DI reading program. Additional data in the form of pre and posttest measures of the WRMT-III yielded gains in reading also. See Table 5 for results.

Table 5

Standard Scores and Grade equivalents for Mia's Pre/Post Test

WRMT-III Subtest	Pretest Scores	Posttest Scores	Net Change
Word Comp	55 (1.1)	55 (1.7)	0 (+0.6)
Passage Comp	57 (1.9)	55 (1.8)	-2 (-0.1)
Reading Comp	55 (1.5)	55 (1.7)	0 (+0.2)
Listening Comp	80 (4.7)	85 (6.2)	+5 (+1.5)
Total Reading	55 (1.5)	55 (1.7)	0 (+0.2)

Tim. For the within strand (parts of speech) analysis, Tim reached criterion for the first behavior (verbs) after 6 probes, and the average level of performance was 90 percent. There was a +4 change in performance level with no overlap of data points with a mean difference of 33 percent between baseline and intervention phases. For the second behavior in the parts of speech analysis (nouns), Tim reached criterion after 6 probes, and the average level of performance was 63 percent. Although there was no immediate change in level of performance with an overlap of 2 data points, the data continued in an upward trend throughout the intervention phase and the mean difference between baseline and intervention phases was 63 percent. For the third behavior, he reached criterion after 15 probes, and the average level of performance was 72 percent. There was a change in level of performance of +3 and a mean difference of 72 percent between baseline and intervention. For the last behavior, Tim reached criterion after three probes the average level of performance was 100 percent. There was a +10 change in performance level. The mean difference between baseline and intervention was 100 percent. See Figure 5 for Tim's performance on the parts of speech skills.

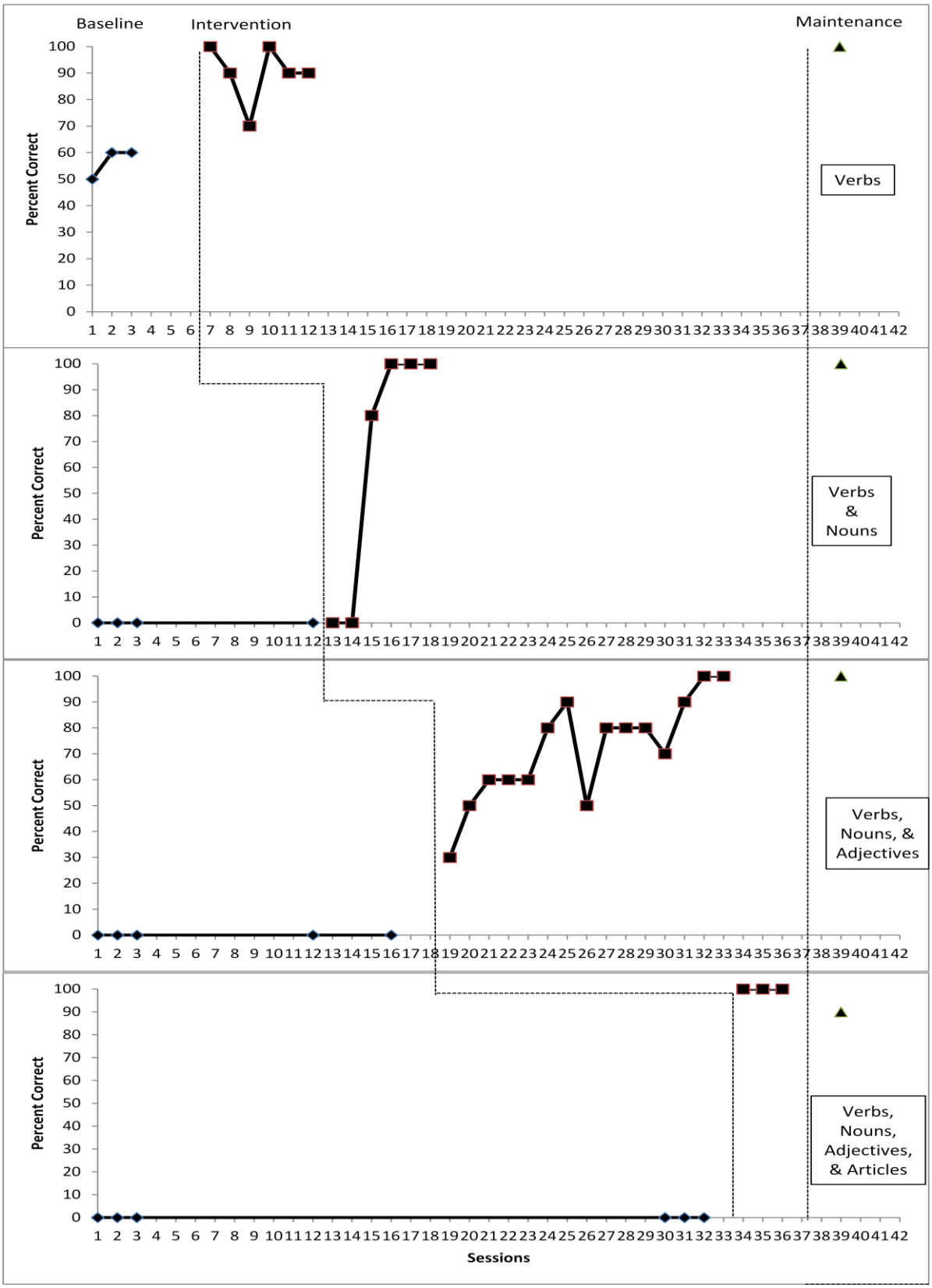

Figure 5. Tim's Performance on Parts of Speech Skills.

In addition to visual analysis of the graph, the percentage of non-overlapping data points was 93 percent. Results from a Tau-U statistic yielded a $p < 0.00$; ES = .92; CI_{95} = 0.51 – 1.32 indicating moderate to strong benefits of the DI reading comprehension program.

For the analysis of across strands skills found within the DI comprehension program, Tim reached criterion for the first behavior after four probes with an average level of performance of 90 percent. There was a change in level of performance of +6 and no overlap of data points. The mean difference between baseline and intervention was 83 percent. For the second behavior (contradictions), Tim reached criterion after 13 probes and the average level of performance was 62 percent. There was a +5 change in level of performance with no overlap of data points and a mean difference of 62 percent between baseline and intervention phases. For the third behavior (same 2), Tim reached criterion after three sessions with an average level of performance of 93 percent. There was a +10 change in level of performance with no overlap of data points. Also a mean difference of 93 percent existed between baseline and intervention phases. For the last behavior (relevant), Tim reached criterion after 8 sessions with an average level of performance of 75 percent. There was an immediate change in level of performance of +2 with a mean difference of 45 percent between baseline and intervention. See Figure 6 for Tim's performance on across strands of skills.

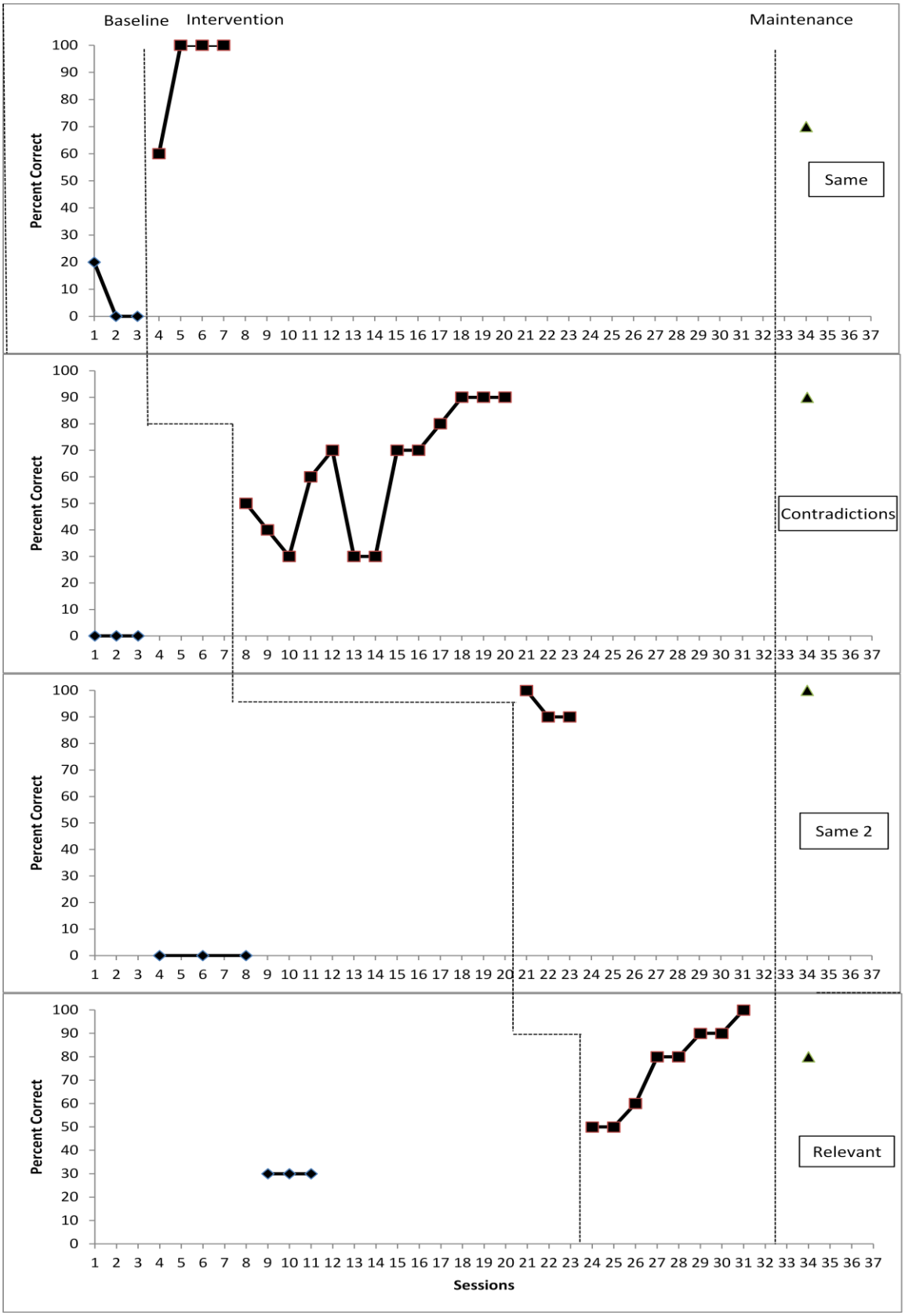

Figure 6. Tim's Performance on Across Strands of Skills.

The percentage of non-overlapping data points was 100 percent. A Tau-U statistic yielded $p < 0.00$; ES = 1; CI_{95} = 0.56 – 1.44 indicating moderate to strong benefits from the DI reading comprehension program.

In addition to visual analysis of graphed data, pre and posttest analysis of reading comprehension skills measured by the WRMT-III indicate substantial gains in all areas of reading comprehension. See Table 6 for WRMT-III results.

Table 6

Standard Scores and Grade Equivalents for Tim's Pre/Posttest

WRMT-III Subtest	Pretest Scores	Posttest Scores	Net Change
Word Comp	55 (2.1)	55 (2.5)	0 (+0.4)
Passage Comp	55 (2.9)	70 (4.8)	+15 (1.9)
Reading Comp	55 (2.5)	61 (3.6)	+6 (1.1)
Listening Comp	58 (<1.0)	69 (4.0)	+11 (+4)
Total Reading	67 (4.2)	74 (5.6)	+7 (1.4)

AIMSWeb Data

Additional data in the form of pre and posttest scores on the maze subtests of AIMSWeb, a curriculum based measure of reading comprehension, was also collected. All three participants exhibited gains from pre to posttest administrations of these measures indicating that students were able to generalize reading comprehension skills to other reading comprehension tasks commonly utilized in classrooms. See Table 7 for individual performance on AIMSWeb subtests.

Table 7

Pre/Posttest Performance on AIMSWeb Maze Subtests

Student	Pretest Number Correct	Posttest Number Correct
Jon	5 ⅔	11⅔
Mia	8 ⅔	13 ⅓
Tim	24 ⅔	30 ⅔

Treatment Fidelity

A special education teacher, with a master's degree, ten years experience, and experience using DI programs, conducted fidelity measures. She observed approximately 20% of the sessions and measured treatment fidelity of the DI lessons using a DI Instruction Checklist (Marchand-Martella, Lignugaris-Kraf, Pettigrew, & Leishman, 1995). Measures focused on presentation, response and pacing, and praise and management. Results indicated that observed sessions were carried out with 100% fidelity in all areas.

Interobserver Reliability

For 20% of the observed sessions, the researcher and an independent observer, a teacher with a master's degree in special education and ten years teaching experience, calculated percent correct on probes independently of one another. The teacher was trained to score each participant's response as either correct (+) or incorrect (-). The number of occurrences for each probe was recorded and then compared. A 100% agreement was found in the scoring of all probes.

Maintenance Procedures

In order to determine if participants were able to retain reading comprehension skills, maintenance probes were collected approximately one month after instruction had ended. Results are included in the graphed data presented in Figures 1–6 and indicate that participants were able to retain skills that were previously mastered.

Social Validity

Students and students' reading teachers each completed a questionnaire as a measure of social validity of the intervention. All students indicated that they liked the reading program and that it helped them to become a better reader. Tim, who received instruction after school, asked repeatedly when he could come back over. All teachers indicated that they noticed an increase in the student's comprehension skills and that DI was an appropriate strategy for the student. In addition, different teachers made comments about student progress throughout the study. One teacher told me, "I can really tell Mia is getting better at reading. She really knows her parts of speech!" Another teacher said that in past 5 years of doing car duty, this is the first year that she had ever seen Mia smile at the end of the day.

CHAPTER V. DISCUSSION

Introduction

The purpose of this study was to examine the effects of the *Corrective Reading Comprehension: B1* program on the acquisition of reading comprehension skills for children with autism and/or intellectual disabilities. The results indicate that a functional relation exists between *Corrective Reading Comprehension: B1* and students' acquisition of reading comprehension skills. Over the course of this study, all three students were able to master specific reading comprehension skills as well as demonstrate significant improvement and generalization of skills to standardized measures for reading comprehension achievement and other classroom tasks commonly used in the general setting. These results confirm that DI is effective in increasing academic achievement for various diverse groups of students (Bradford, Shippen, Alberto, Houchins, & Flores, 2006; Carlson & Francis, 2002; Flores, Shippen, Alberto & Crowe, 2004; Foorman, Francis, Fletcher, & Schatschneider, 1998; Frederick, Keel, & Neel, 2002; Gersten & Maggs, 1982; Grossen, 2004; Shippen, Houchins, Steventon, & Sartor, 2005; Swanson, 1998; Torgesen, et al., 2001) as well as those with autism (Flores & Ganz, 2007, 2009; Ganz & Flores, 2009; Zayac, 2009). Furthermore, these findings extend the current literature base to indicate that DI is effective for secondary students with autism and for teaching more cognitively complex comprehension skills.

The importance of the findings presented here cannot be understated. As federal and state laws require increased accountability, the identification and implementation of evidence based practices is imperative. In addition, as the prevalence and incidence of autism continues to rise, there is a need to identify not only teaching methodologies, but also curricula that are most effective for this unique population. Although this study did not compare the DI reading comprehension to other programs, DI has a long documented and established history for effectiveness and efficacy. The results of this study indicate that students with disabilities, specifically those with autism, can make significant academic gains when provided with appropriate instruction. It is disheartening that, given the extensive research regarding the effectiveness of DI, this methodology and curricula is underutilized in educational settings. Regardless, the findings of this study support the efficacy of DI for students with autism and will eventually help establish DI as an evidenced based practice for this population.

Results

This study confirms and extends previous research. Although initial testing of IQ and reading achievement were not the primary focus of this study, results confirm previous findings that younger individuals with autism often score higher on nonverbal portions of IQ assessments (Allen, Lincoln, & Kauffman, 1991; Mayes & Calhoun, 2003; Rumsey, 1992), whereas usually no differences exist for older students with autism (Mayes & Calhoun, 2003). The youngest participant with autism, aged 10, exhibited a 43 point discrepancy between verbal and nonverbal subtests of the KBIT-2, whereas the oldest participant with autism, aged 16, exhibited a two point discrepancy between the two subtests. The participant with an intellectual disability performed better on the verbal subtest with a 26 point discrepancy between these two areas.

The results of this study are also consistent with previous research in that students with autism often score higher on word decoding versus comprehension portions of standardized measures of reading (Chiang & Lin, 2007; Frith & Snowling, 1983; Humer & Mann, 2009; Minshew, Goldstein, Taylor, & Siegal, 1994; Nation, Clarke, Wright, & Williams, 2006; Tager-Flusberg, Paul, & Lord, 2005; Wahlberg & Magliano, 2004). Initial achievement testing indicated that both participants with autism exhibited relative strengths in the area of decoding. Jon exhibited a 17 point discrepancy and Tim exhibited a 13 point discrepancy between decoding and comprehension subtests of the WRMT-III.

The results of this study also confirm the findings of previous research which has indicated that DI is an effective methodology for diverse groups of students, including those from low socioeconomic backgrounds (Goldman, 2000; Torgesen, Alexander, Wagner, Rashotte, Voeller, & Conway, 2001), students at-risk for academic failure (Carlson & Francis, 2002; Foorman, Francis, Fletcher, & Schatschneider, 1998; Frederick, Keel, & Neel, 2002; Grossen, 2004; Shippen, Houchins, Steventon, & Sartor, 2005), students with learning disabilities (Swanson, 1998; Torgesen et al.), and students with cognitive deficits (Bradford, Shippen, Alberto, Houchins, & Flores, 2006; Flores, Shippen, Alberto & Crowe, 2004; Gersten & Maggs, 1982). Each of the three participants included in this study was eligible for free and reduced lunch and had previously been identified at-risk for academic failure as evidenced by eligibility for special education services. Furthermore, two of the participants exhibited discrepancies greater than 20 points between verbal and nonverbal subtests of the KBIT-2 indicating probable learning disabilities as well. Although Jon's intellectual functioning fell slightly in the below average range, Mia and Tim's intellectual functioning fell in the intellectual disability range.

This study also supports previous contentions that indicate students with autism can improve basic reading skills (Zayac, 2009) as well as language and reading comprehension skills (Flores & Ganz, 2007, 2009; Flores, Nelson, et al., 2013; Ganz & Flores, 2009). All three students included in this study were able to master the skills observed within the DI program, made gains on standardized measures of reading achievement, and were able to generalize and make gains in relation to other classroom tasks involving reading achievement.

The results of this study extend findings from previous research. This study implemented a DI comprehension program in its entirety as all three students completed the 60 lesson B1 level program. Treatment fidelity was established and no modifications were made to the program. In addition, individuals with autism who exhibited significantly below-average intellectual functioning were included in this study. The students included in this study were older students with autism. Finally, the dependent variables in this study extended previous research in that comprehension skills were more cognitively complex than previously cited studies.

Considering the success of the participants in this study as well as the overwhelming evidence of the efficacy of DI programs for a variety of individuals as well as emerging evidence for those with autism, it is worthwhile to explore and explain factors that most likely contributed to the efficacy of this program for individuals in this study. Programs developed from behavioral theory are perhaps the most effective for those with autism. For example, applied behavior analysis is generally regarded as the treatment of choice for individuals with autism since Lovaas' seminal study in 1987. Since this time, significant research and litigation have been devoted to this type of therapy. DI is a specific set of academic curricula that is rooted in behavioral theory and has similarities to that of ABA. Research has supported that specific components which contribute to the efficacy of these programs is that they both focus on

measurable behaviors and provide carefully designed instruction (Knight et al., 2013) which includes predictable instructional formats (Hume et al., 2012) with high rates of responding (Lamella & Tincani, 2012) and immediate feedback (Ranick, et al., 2013). Given the efficacy of DI and the success of the participants in this study, it is worthwhile to discuss factors that most likely contributed to each student's progress.

All three participants were able to master specific reading comprehension skills presented within the DI program as well as generalize these skills to a norm referenced test of reading achievement. In addition, all three students were able to generalize these skills to other measures of reading comprehension commonly found in general education classrooms. One factor which may have affected each student's performance was each student's special education services and placement into the general education classroom. All three participants received instruction in general education classrooms alongside their nondisabled peers for reading/language arts; however, instruction for this study was delivered in a one-on-one setting. Given that all three students were significantly below grade level in reading comprehension, it is likely that current instruction in the general education classroom was not appropriate. Considering that the two participants had documented difficulty with attention, it is probable that one-on-one instruction maximized on-task behavior as well. Although both students with autism would often attempt to engage in repetitive, irrelevant discussions, both were easily redirected. Furthermore, the authors of the DI program state that these programs are designed to teach more in less time, making it possible for students to not only progress, but to be able to catch up if they have fallen behind. Regardless, as a result of one-on-one instruction, all three students were able to master reading comprehension skills quickly. Factors affecting individual performance are discussed below.

Jon

The first participant was a 10-year-old white male with autism. Jon was eager to begin instruction each day and seemed to enjoy "helping" this researcher with her study. Initial testing indicated that Jon exhibited a personal weakness in the area of comprehension; however, results of testing at the conclusion of the study indicated that he had made significant progress in standardized measures of comprehension and comprehension was no longer a weakness. Throughout both analyses of comprehension skills, Jon reached mastery faster than the other participants and made the largest gains in all reading comprehension areas of the WRMT-III. This was most likely due to higher intellectual functioning, as his IQ was more than one standard deviation higher than either of the other participants. Jon learned the skills presented very quickly and required no remediation of skills throughout the program. The generalization of reading comprehension skills was evident in gains on AIMSWeb curriculum-based measures.

Mia

Mia, the second participant, was a 14-year-old African American female with an intellectual disability. Like Jon, Mia was eager to participate in the study. Mia was able to master the skills in the reading comprehension program; however, Mia's gains on standardized measures of reading achievement were not as significant as the other two participants. Both decoding and comprehension skills were significantly weak areas for Mia, and it is plausible that reading decoding set the ceiling for her reading comprehension scores. Perhaps a DI program that focuses on both decoding and comprehension would have been more appropriate. Another possible explanation is that standard scores for the WRMT-III truncate at a score of 55, and possibly masking gains in reading comprehension. Regardless, she was able to master the reading comprehension skills, and generalize some gains to the WRMT-III as well as to

AIMSWeb curriculum based measures. Mia also made a 1.5 grade level gain in the area of listening comprehension as measured by the WRMT-III, indicating likely potential to make similar gains in reading comprehension if decoding skills were improved.

Tim

Tim, the third participant, was a 16 year old male diagnosed as having high functioning autism. Like the other participants, Tim was eager to participate in the study and seemed to enjoy the individual attention. Tim was able to master skills quickly, however those skills which required sustained attention or those which were more cognitively complex took longer to master than the easier ones. It is unclear whether this difficulty was due to attention difficulties or cognitive difficulties or a combination of both; however, Tim worked very quickly, did not check over his work, and skipped around sporadically when completing probes. Tim's lack of attention was possibly exacerbated by his receiving instruction in the afterschool program after school hours. Regardless, Tim was able to make substantial gains in both standardized measures and curriculum based measures of reading comprehension.

As the results of this study indicate that the DI comprehension program is highly effective in improving the comprehension skills of individuals with autism, it is important to discuss the interplay of components. First, it is important to note that the results indicate that the participant with a higher IQ improved comprehension skills faster and made larger gains in standardized measures of reading achievement. Second, the participants with higher basic skills also improved comprehension skills faster and made larger gains. Due to the small number of participants, it cannot be determined which variable – the IQ level or basic reading skills level – contributed most to the positive outcomes for each student. Regardless, the results of this study

indicate that students with autism can make substantial academic gains and can catch up to their nondisabled peers when provided with appropriate instruction.

Another important finding from this study is that all three participants were able to maintain skills learned one month after instruction had ended. Given the nature of the DI program that focuses on cumulative review, even after a skill has been mastered, these results are no surprise. However, students with disabilities sometimes have difficulty with generalizing skills to other situations. Therefore, a component of this study was to examine whether students would generalize gains in reading comprehension skills to gains in other measures of reading comprehension commonly found in the classroom. All three students demonstrated gains on a curriculum based measure of reading comprehension indicating that students are able to generalize skills to other reading comprehension tasks.

In addition to the academic success of the participants in this study, it is equally important to discuss the social validity. All three participants seemed to genuinely enjoy participating in the study. Although one-on-one teacher attention contributed significantly to this, all three students indicated that they liked the program, felt like the program made them a better reader, and would use the program again if he teacher wanted them to. In addition, social validity from student's regular education teachers was powerful as well. Student's teachers indicated that they noticed meaningful increases in students reading comprehension skills and on-task behaviors. A teacher's aide even commented that the student had done more while using the DI reading program than he had done all year. Given the reluctance of schools to use programs that are not new, it is important to establish social validity of evidenced based and promising academic programs.

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Limitations

Although the findings from this study indicate a functional relation between the DI reading comprehension program *Corrective Reading Comprehension: B1* and students' acquisition of reading comprehension skills, some limitations exist. First, each student received one-on-one instruction. This one-on-one attention most likely positively and significantly influenced student motivation and time on task; therefore it is not known whether students who receive instruction in small group or whole group settings would yield the same results. Another limitation is that only three participants diagnosed with either autism or intellectual disability were included in the study. It cannot be determined if individuals from the larger population would yield similar results.

Since this researcher delivered the majority of the instruction, these results cannot be generalized to instruction delivered by a general education or special education teacher. This study fulfills partial requirements for a Ph.D. degree in special education. Furthermore, this researcher is trained in the use of DI and has over 14 years experience using the program. However, it is notable that other studies have found DI to be effective when delivered by general education classroom teachers (Clunies-Ross, 1990; Kasendorf & McQuaid, 1987; Sommers, 1995; Vitale, Medland, Romance, & Weaver, 1993), special education teachers (Benner, Kinder, Beaudoin, Stein, & Hirschmann, 2005; Flores, Shippen, Alberto, & Crowe (2004), and even paraprofessionals (Gersten, Brockway, & Henares, 1983; Keel, Fredrick, Hughes, & Owens, 1999) and peer instructors (Harris, Marchand-Martella, & Martella, 2000; Marchand-Martella, Martella, Orlob, & Ebey, 2000; Short, Marchand-Martella, Martella, Ebey, & Stookey, 1999). Additionally, time spent on instruction was extensive. Due to time constraints, time on task was maximized and students completed at least 2 lessons per day; therefore, DI instruction which is

less intense would probably not yield as significant results that have been shown here. Third, this study did not compare DI to any other reading programs. In order to generalize to a larger population, additional testing with a larger sample of children with varying levels of functioning is needed.

Recommendations for Future Research

Given the outcomes and limitations of this study, there are several recommendations for future research in regard to teaching reading to individuals with autism. First, replications of this study are needed in order to confirm whether significant reading comprehension gains are common when implemented with the same type intensity. At some point, researchers and practitioners will reach a point of diminishing returns, where more intense instruction will not result in additional gains. It would be interesting to establish at what intensity this would likely occur. Also, it would be interesting to establish whether DI has similar, positive effects on fluency and decoding for students with autism. Future research should skills which include even more complex reading comprehension skills which are more cognitively complex and might also focus on adults with autism.

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APPENDIXES

Appendix A

Skills Presented in Corrective Reading Comprehension: B1

- Reasoning Skills
  - Deductions
  - Evidence
  - Analogies
  - Contradictions
- Information Skills
  - Classification
  - Body Systems
  - Body Rules
- Vocabulary Skills
  - Definitions
- Sentence Skills
  - Parts of Speech
  - Sentence Combinations
  - Subject/Predicate
- Basic Comprehension Skills
  - Inference
  - Following Directions
- Writing Skills
  - Writing Stories
  - Writing Directions

Appendix B
Sample Probe for Parts of Speech

Probe 8

Draw a line over the adjectives. Draw a line under the nouns. Circle the verbs.

1. Her sister and his friend went on a date.
2. Her friend was studying and taking a test.
3. The weatherman predicted a hot summer.
4. Babies like predictable stories.
5. Six boys went to the hockey game.
6. Ten dogs were digging in the backyard.
7. Kids looked at that new game.
8. Those guys are building new homes.
9. Those dogs were barking at the cat.
10. His teacher is going to the school.

Appendix C

Sample Probe for Same Skill

Directions: Underline the common part and combine the sentences with and

Luke and Jake went to the rodeo. Luke and Jake ate watermelon. _____ _____	Hal beats the drums. Hal plays the piano. _____ _____
Cathy has the flu. Jase has the flu. _____ _____	The man examined John's dump truck. The man drove John's car. _____ _____
Rats were in the barn. Weevils were in the barn. _____ _____	Sissy is playing football. Her brother is playing football. _____ _____
He bet on the race. He bet played in the game. _____ _____	The dog was in the crate. His toy was in the crate. _____ _____
That lizard has stripes. That zebra has stripes. _____ _____	That dog ate 2 bags of food. This cat ate 2 bags of food. _____ _____

Appendix D

Sample Probe for Contradiction Skill

Directions: If a statement is true, its contradiction is false. The first statement in each item is true. Circle the contradictions.

Every body part does a job. 1. The heart does a job. 2. The lungs do not do a job. 3. Only some body parts do a job. 4. The ribs and spine do not do a job.	Only plants and animals are living things. 1. Only plants are living things. 2. A spoon is not a living thing. 3. A desk is a living thing. 4. Only plants are alive.
Every bone needs calcium. 1. A femur does not need calcium. 2. A humerus needs calcium. 3. Only some bones need calcium. 4. No part of the skeletal system needs calcium.	Ribs are in the skeletal system. 1. The ribs are in the digestive system. 2. The ribs are in the system of bones. 3. The ribs are in the system of muscles. 4. The ribs are bones.
All birds have only two legs. 1. Only some birds have two legs. 2. All birds have three legs. 3. Every bird has two legs. 4. No birds have two legs.	Justin is faster than Riley. 1. Riley is slower than Justin. 2. Justin is slower than Riley. 3. Justin is not faster than Riley. 4. Riley is not as fast as Justin.
All horses have four legs. 1. Only some horses have four legs. 2. All horses have three legs. 3. Every horse has four legs. 4. No horses have four legs.	Every living thing needs water. 1. A plant does not need water. 2. A cow needs water. 3. Only some animals need water. 4. No animals need water.
Every professional works. 1. A doctor works. 2. A lawyer does not work. 3. Only some professionals work. 4. Teachers and accountants do not work.	Lungs are in the respiratory system. 1. Lungs are in the skeletal system. 2. Lungs are in the system of blood. 3. A babies' lung is in the reproductive system. 4. Lungs help you breathe.

Appendix E

Sample Probe for Relevant Skill

Directions: Write an R for each fact that is relevant to what happened and an I for each fact that is irrelevant.

1. The horse kicked the rider. a. The rider was mean to the horse before he kicked him. b. The horse had black spots. c. The rider was old. d. The horse disliked people.	2. The dog limped when he ran. a. He had a red collar. b. He had a thorn in his foot. c. He had a pain in his ear. d. He pulled a leg muscle.
3. Her mother burned the steak. a. She had never cooked a steak before. b. She put the burner on high. c. She liked big meals. d. She didn't put any butter in the pan.	4. The man slammed on his brakes. a. A deer ran in front of his car. b. He had on a suit. c. He didn't want to hit the deer. d. He was driving a red truck.
5. Mark did not eat lunch that afternoon. a. He had eaten a bag of chips before lunch. b. He ran every evening. c. He had been sick. d. He wore his favorite hat.	6. The girl got up at 5 a.m. a. She had to be at school at 7 a.m. b. She had a pink alarm clock. c. Her teacher had a blue dress. d. She liked to do her homework early in the morning.
7. There were bugs in the house. a. The house was very big. b. The food was left uncovered. c. They left the doors open. d. The walls were painted white.	8. John's tractor wouldn't start. a. His tractor was a John Deere. b. He had just obtained the tractor. c. The gas line was broken. d. It didn't have a spark plug.
9. Mary rode her bike to work. a. She lived close to work. b. She worked in a school. c. She went to bed early. d. She didn't have a car.	10. The man obtained some tools. a. He was building a dog house. b. His saw was very dull. c. He paid for the tools with a credit card. d. The store was a long way from his house.

Appendix F
Treatment Integrity Checklist

Marchand-Martella, N., Lignugaris-Kraft, B., Pettigrew, T., & Leishman, R. (1995).

Formal/Informal 1 2 3 4

DIRECT INSTRUCTION CHECKLIST

Practicum Student _____ Cooperating Teacher _____

Supervisor _____ Date _____

Overall ScoreP / Total 84 - (#DK*4)

Note: If Item 10 is scored DK subtract an additional 8 from Total Possible

Cooperating Teacher ____/____ = ____%

Supervisor ____/____ = ____%

\+

Total Rating = ____/____ = ____%

		All of the time	Most of the time	Some of the time	Rarely	Never	Don't Know
	Presentation						
1.	All materials ready prior to lesson	4	3	2	1	0	
2.	Provides necessary direction to pupils to start lesson, find page, or get necessary supplies prior to beginning the lesson.	4	3	2	1	0	DK
3.	Uses format as prescribed by manuals	4	3	2	1	0	
4.	Maintains eye contact with pupils during presentation (scans entire group)	4	3	2	1	0	
5.	Uses smooth phrasing & emphasizes key words	4	3	2	1	0	
6.	Is enthusiastic when teaching (tone of voice is expressive and natural, loud enough to be heard, but does not interfere with other classroom activities)	4	3	2	1	0	
	Responses & Pacing						
7.	Individual turns are spread out over entire lesson rather than in just one or two spots	8	4	2	1	0	
	Praise & Management						
8.	Pupil voice tone is appropriate. (Is loud enough to be heard, but does not interfere with other classroom activities).	4	3	2	1	0	
9.	Reinforces pupils when they follow classroom rules and behavior that supports correct academic responding	12	6	2	1	0	
10.	Follows classroom behavior management plan for problem behaviors	12	6	2	1	0	DK
	Other						
11.	Maintains pupil records daily (student's and cooperating teacher's)	4	3	2	1	0	DK
12.	Maintains confidentiality of information/records	4	3	2	1	0	DK
13.	Checks school schedule weekly. Adapts to changes in classroom routine	4	3	2	1	0	DK
14.	Dresses appropriately & maintains personal hygiene	4	3	2	1	0	DK
15.	Responds favorably to constructive feedback	4	3	2	1	0	DK
16.	Implements suggested changes after feedback is provided	4	3	2	1	0	DK

_____+ _____+ _____+ _____= _____ Overall Score

Appendix G
Social Validity Questionnaire (Teacher Form)

Student: _____Teacher: _____ Date: _____

This questionnaire consists of 8 items. For each item, you need to indicate the extent to which you agree or disagree with each statement by circling one of the five responses to the right.

Questions	Responses				
1. The reading comprehension behaviors selected for interventions were important and appropriate for this student.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
2. The intervention *Corrective Reading Comprehension B1* is important and appropriate for this student.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
3. I noticed meaningful increases in the student's reading comprehension skills after the implementation of *Corrective Reading Comprehension B1*	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
4. I noticed meaningful increases in the student's on-task behavior after the implementation of *Corrective Reading Comprehension B1*.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
5. I noticed meaningful increases in task completion after the implementation of DI.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
6. *Corrective Reading Comprehension B1* is a useful and appropriate strategy for increasing reading comprehension skills	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
7. I am considering the use of *Corrective Reading Comprehension B1*or other DI reading comprehension program in the future.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
8. I am considering the use of *Corrective Reading Comprehension B1* or another DI reading comprehension program with students with similar reading deficits in the future.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

Appendix H
Social Validity Interview (Student Form)

Student: _____ Interviewer: _____ Date: _____

Questions

1. I like the reading program *Corrective Reading: Comprehension B1*. Yes Maybe No
2. The program helped me be a better reader. Yes Maybe No
3. The program helped me get more school work done. Yes Maybe No
4. I would use the program again if the teacher wants me to. Yes Maybe No
5. What did you learn from this reading program?

6. What did you like best about the program?

7. What did you not like about the program?

8. If you were in change, what would have you changed about the program?

9. Is there anything else you want to say about the program?

Appendix I
Parental Consent Form for Direct Instruction Study

AUBURN
UNIVERSITY
DEPARTMENT OF
SPECIAL EDUCATION,
REHABILITATION, AND COUNSELING

(NOTE: DO NOT AGREE TO PARTICIPATE UNLESS AN APPROVAL STAMP WITH CURRENT DATES HAS BEEN APPLIED TO THIS DOCUMENT.)

PARENTAL PERMISSION/CHILD ASSENT
for a Research Study entitled
"Effects of Direct Instruction in Reading Comprehension for Individuals with Autism Spectrum Disorder or Developmental Delay"

Your son or daughter is invited to participate in a research study to determine the effects of Direct Instruction in Reading Comprehension for individuals with autism spectrum disorder or developmental delay. The study is being conducted by *Cindy Nelson Head, PhD student*, under the direction of Margaret Shippen, Professor in the Auburn University Department of Special Education, Rehabilitation, and Counseling. Your son or daughter is invited to participate because he or she is a secondary student who might benefit from additional instruction in the area of reading comprehension and has been recommended by his/her teacher. Since he/she is age 18 or younger we must have your permission to include him/her in the study.

What will be involved if your son/daughter participates? If you decide to allow him/her to participate in this research study, he/she will be asked to participate in daily reading instruction. In addition, he/she will be asked to complete reading assessments which will measure his/her progress in reading, a brief I.Q. test to assess intellectual functioning, an achievement test to determine current reading achievement levels, and a placement test to determine where to begin instruction. Your son's/daughter's total time commitment will be approximately 45 minutes daily for 8 weeks. Approximately 30% of the instructional sessions will be videotaped to ensure that the teacher follows the script and procedures provided within the reading program. Also, you consent to allow this researcher permission to access your child's educational records for the purpose of describing his/her disability.

Are there any risks or discomforts? The risks associated with participating in this study are breach of confidentiality. To minimize these risks, we will not directly link your son/daughter's name or any other personally identifiable information to the data collected.

Are there any benefits to your son/daughter or others? If he/she participates in this study, he/she can expect to improve his/her reading comprehension skills. We/I cannot promise you that your son/daughter will receive any or all of the benefits described.

Parent/Guardian Initials_____
Participant Initials_____

2084 Haley Center, Auburn, AL 36849-5222; Telephone: 334-844-7676; Fax: 334-844-7677
www.auburn.edu/serc

If you (or your son/daughter) change your mind about his/her participation, he/she can be withdrawn from the study at any time. His/her participation is completely voluntary. If you choose to withdraw your son/daughter, his/her data can be withdrawn as long as it is identifiable. Your decision about whether or not to allow your son/daughter to participate or to stop participating will not jeopardize your or his/her future relations with Auburn University, the Department of Special Education, Rehabilitation, and Counseling or Roanoke City Schools.

Your son's/daughter's privacy will be protected. Any information obtained in connection with this study will remain confidential. The data collected will be protected by assigning an alternate identification during the data collection process. Information obtained through his/her participation may be used to fulfill requirements for a dissertation.

If you (or your son/daughter) have questions about this study, *please ask them now or* contact Cindy Nelson Head at (334)338-0288 or Margaret Shippen at (334)844-2123. A copy of this document will be given to you to keep.

If you have questions about your child's rights as a research participant, you may contact the Auburn University Office of Research Compliance or the Institutional Review Board by phone (334)-844-5966 or e-mail at IRBadmin@auburn.edu or IRBChair@auburn.edu.

HAVING READ THE INFORMATION PROVIDED, YOU MUST DECIDE WHETHER OR NOT YOU WISH FOR YOUR SON OR DAUGHTER TO PARTICIPATE IN THIS RESEARCH STUDY. YOUR SIGNATURE INDICATES YOUR WILLINGNESS TO ALLOW HIM OR HER TO PARTICIPATE. YOUR SON'S/DAUGHTER'S SIGNATURE INDICATES HIS/HER WILLINGNESS TO PARTICIPATE.

Participant's signature Date

Printed Name

Parent/Guardian Signature Date

Printed Name

Investigator obtaining consent Date

Printed Name

Co-Investigator Date

Printed Name

Appendix I
Student Assent

AUBURN
UNIVERSITY

DEPARTMENT OF
SPECIAL EDUCATION,
REHABILITATION, AND COUNSELING

The Auburn University Institutional Review Board has approved this document for use from 09/16/15 to 09/15/16
Protocol # 15-262 MR 1509

MINOR ASSENT
for a research study entitled
"Effects of Direct Instruction in Reading Comprehension for Individuals with Autism Spectrum Disorder"

You are invited to be in a research study to help us understand how some children respond to reading instruction.

If you decide you want to be in this study, you will be asked to participate in 45 minutes of reading instruction daily for approximately 8 weeks.

Some of the time that you are reading, we will have a movie camera on, taking a video of you. We need the video to study later to make sure that the teacher teaches the way he or she is supposed to - after you go home. We can only make the video if you and your parent(s) or guardian give us permission to do that.

You can stop at any time. Just tell your parents or Cindy Nelson Head if you don't want to read any more. No one will be angry with you if you stop reading.

If you have any questions about what you will do or what will happen, please ask your parents or guardian or ask Cindy Nelson Head now. If you have questions while you are reading we want you to ask us.

If you have decided to help us, please sign or print your name on the line below.

Child's Signature	Printed Name	Date
Parent/Guardian Signature	Printed Name	Date

(Parent/Guardian must also sign Parent/Guardian Permission form!)

Investigator obtaining consent	Printed Name	Date

Page 1 of 1

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