

Comparing and Combining Accommodation and Remediation Interventions to
Improve the Written Language Performance of Children with
Asperger's Syndrome

by

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This manuscript has been read and accepted for the Graduate Faculty in Educational Psychology in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

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Abstract

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This study examined the relative effectiveness of two writing accommodations (word processing and speech recognition technology) as compared with handwriting alone on improving the writing fluency of four boys with Asperger's Syndrome (AS). This study also examined whether the pairing of the most effective writing accommodation with a widely used and empirically supported writing intervention (SRSD; Self-Regulated Strategy Development) would further improve fluency as well as accuracy and story quality. A multiple phase alternating treatments design with a final treatment phase was used to first compare the two accommodations with handwriting (first phase) and then the most effective accommodation with SRSD (second phase). Four variables were used to assess writing skills, two measuring fluency (total words written and number of words in a complete sentence), one measuring accuracy (percentage of correct word sequences), and one measuring story quality and completeness (number of story parts). It was hypothesized that the use of the speech recognition accommodation would result in the most fluently written stories but that the addition of the SRSD intervention would further improve fluency but also improve writing accuracy and story

quality. In addition, these gains would generalize to the participants' creative writing assignments.

Outcomes indicated that the speech recognition accommodation improved writing fluency and writing quality far better than the word processing and handwriting accommodation. Speech recognition alone also improved writing accuracy for two of the participants who struggled with spelling. Results further suggested that word processing, although frequently recommended for this population, was not an effective accommodation for these participants. SRSD with handwriting did not improve fluency for these participants, though the intervention did improve story quality. It was the combination of the SRSD intervention with speech recognition that resulted in lengthier, most fluent, and highest quality written work when compared to SRSD with handwriting, speech recognition alone, and handwriting alone. Although SRSD with speech recognition had very little impact on improving writing accuracy, it was more helpful for the participants who struggled with spelling. As hypothesized, writing improvements were generalized to participants' creative writing homework assignments.

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Lastly, I would like to thank all the children and adolescents on the autism spectrum with whom I have had the pleasure of working throughout the years. I hope to continue to help make their lives less challenging at school, empower administration and teachers to protect, accept, and accommodate these students' special needs, and help them become more appreciated by those who do not understand them. As they navigate through their school years, I am hopeful that more adults will recognize their special talents and unique gifts and help them channel those talents so they can become happier, productive, and more independent individuals.

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Chapter I

Introduction

In 1994, the *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV*; American Psychological Association, 1994) officially recognized AS as a distinct pervasive developmental disorder (PDD). As a result, practitioners and researchers know relatively little about actual prevalence rates or the impact of the disorder on students' academic functioning. Khouzam, El-Gabalawi, Pirwani, and Priest (2004) suggested that prevalence rates may vary from 3.6 per 1000 (Ehlers & Gillberg, 1993) to 7.1 per 1000 (Tonge, 2002) children, depending on the stringency used in diagnosis. Gillberg and Gillberg (1989) estimated that AS is five times as common as autistic disorder, which may reflect the recent report of increased prevalence rates of all autism spectrum disorders as being as high as 1 in 91 children (Kogan et al., 2009). An unfortunate complication to the determination of prevalence is that approximately 50% of individuals with AS reach adulthood without receiving a diagnosis or obtaining treatment, which is of concern since these individuals frequently have substantial interpersonal difficulties, often experience academic and school problems, and ultimately encounter difficulties living independently (Barnhill, 2001a; Khouzam et al., 2004).

There is some evidence suggesting that long-term academic outcomes for children who fall on the higher functioning end of the autistic spectrum are poor, although the scant amount of longitudinal research has not focused exclusively on AS, instead it has considered those with Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS), high functioning autism, and AS as belonging in a single, higher functioning, collective group (Barnhill, 2007). Howlin (2003) examined the outcomes of individuals who were considered to fall on the higher end of the autistic spectrum, which included the aforementioned diagnoses, reporting that only

16% attend college, 14% receive university degrees, and 24% obtain employment. Those individuals who do obtain employment often take jobs that are far below their skill levels due to their difficulties navigating the social world (Barnhill, 2007). These statistics are particularly alarming for children and adolescents with AS, as these students typically have average to high average cognitive potential (Griswold, Barnhill, Myles, Hagiwara, & Simpson, 2002).

Fortunately, researchers have begun to examine and address some of the academic difficulties students with AS face on a daily basis (Church, Alisanski, & Amanullah, 2000) in response to the notable lack of educational system support for students with AS (Prior, 2003).

Until recently, there have been very few studies that have examined the unique academic characteristics of students with AS (Safran, 2005). Recent research (Myles et al., 2003) and anecdotal evidence (Church et al., 2000; Fondacaro, 2001) suggests that students with AS tend to struggle specifically with writing. Interestingly, students with AS typically do not appear to have difficulties with the more rule-based and easily memorized aspects of writing such as spelling, grammar usage, and punctuation (Fein & Dunn, 2007). The literature cites specific weaknesses in writing fluency, organization, sentence complexity (Church et al., 2000; Myles et al., 2003), poor fine-motor skills and handwriting, and general disdain for the physical demands of the writing process (Fondacaro, 2001; Ghaziuddin, Butler, Tsai, & Ghaziuddin, 1994; Gross, 1994). Students with AS also have difficulties in developing a cohesive, well developed, and qualitatively rich written product (Fein & Dunn, 2007).

To date, there has not been any research assessing the effectiveness of specific writing accommodations exclusively for children with AS (Manjiviona, 2003). However, many clinicians working with this population have discussed best practice guidelines in the provision of writing accommodations for students with AS to alleviate and address the physical demands

of the writing process (Attwood, 2006; Church, 2000; Fein & Dunn, 2007; Myles et al., 2003).

The literature suggests accommodations that include the use of a scribe or a tape recorder as well as providing additional time to complete written tasks, having the opportunity to complete multiple choice instead of essay exams, or allowing the student to orally respond to test questions rather than through writing (Manjiviona, 2003; Myles et al., 2003; Safran, Safran, & Ellis, 2003). Another commonly suggested accommodation is the use of a word processor (WP), which is believed to alleviate some of the fine-motor demands of writing (Myles et al., 2003). To date, no one has suggested or explored the use of a speech recognition (SR) technology accommodation, in which individuals dictate their stories into a microphone enabling transcription of answers onto a computer screen, for this population. However, SR is an accommodation often used for students with dysgraphia and may also serve to completely alleviate the fine-motor stressors of writing and allow the student to express himself or herself more fluently (Bangert-Drowns, 1993; Cochran-Smith, 1991; De La Paz, 1999; Hetzroni & Schreiber, 2004; MacArthur & Graham, 1987).

There is a paucity of research regarding the efficacy of specific writing interventions for students with AS. Anecdotal reports borrowed from similar populations form the basis of best practice interventions and techniques throughout the literature (Fein & Dunn, 2007; Myles et al., 2003; Myles & Simpson, 2001; Safran et al., 2003). Authors have derived most of these recommendations from literature addressing students with writing difficulties and/or fine-motor deficits that interfere with the writing process. Various articles have suggested interventions for students with AS that include the use of priming, the use of their own written work to learn to elaborate on their writing, peer modeling, graphic organizers, and self-modeling (Delano, 2007; Fein & Dunn, 2007; Myles et al., 2003; Myles & Simpson, 2001; Safran et al., 2003). Given the

evidence that students with AS typically have difficulties with the physical demands of writing as well as with written expression, some researchers have suggested that a combination of an accommodation and an intervention may produce the best outcomes (Berninger, Neilson, & Abbot, 2008; MacArthur, 2000; Quinlan, 2004).

Research shows that only one specific writing intervention, Self-Regulated Strategy Development (SRSD), is effective for students with AS (Asaro, 2009; Asaro & Saddler, 2009; Delano, 2007). The SRSD intervention combines many of the interventions suggested in the literature that target the writing deficits of students with AS and teaches students how to incorporate the essential story elements required in good writing. SRSD includes a modeling component, elements of self-monitoring, as well as the use of graphic organizers (Delano, 2007; Fein & Dunn, 2007; Myles et al., 2003; Myles & Simpson, 2001; Safran et al., 2003). Thus, researchers believe that SRSD is useful for students in this particular population, as it helps them produce a more complete, fluent, and well organized written product. Furthermore, since students with AS often reportedly become frustrated when engaged in writing tasks, SRSD also includes the use of self-statements to help guide students when they get “stuck” in the idea generation phase or begin to feel discouraged (Graham & Harris, 2005; Winter-Messiers, 2007; Winter-Messiers et al., 2007).

Purpose of Present Study

The primary purpose of this present dissertation was to compare the isolated effects of WP and SR technology accommodations and the combined effect of the most successful accommodation with a writing intervention (SRSD) on the curriculum based measurement (CBM) writing performance of students with AS (e.g., combining SR with SRSD will increase writing fluency and improve writing accuracy and quality to a greater extent than SR alone).

Students with AS who very capably demonstrate their knowledge verbally may not be able to do the same when teachers require them to write (Myles et al., 2003). Without assistance in this specific area, many of these students will likely be placed in academic jeopardy and not meet their cognitive potential.

Given that the literature has often recommended that students with AS receive accommodations to address their handwriting difficulties (Myles et al., 2003), it is important to explore these accommodations to determine their empirical support for use with this specific population. Furthermore, it is important to accommodate students AS not only for their fine-motor difficulties, but also to provide them with empirically-supported writing interventions to teach them how to improve the quality of their written work.

The first goal of the study is to examine the relative effectiveness of the WP accommodation when compared with work that is handwritten. A second goal is to determine the effectiveness of the SR accommodation, which has yet to be recommended for and empirically demonstrated with this particular population, when compared to handwriting samples of students with AS. It is hypothesized that both accommodations will produce better written language outcomes than handwriting alone.

A third goal is to determine the relative effectiveness of these two different writing accommodations to improve the written language skills of children diagnosed with AS. It is hypothesized that students with AS will produce lengthier, more fluent written products when assisted with SR technology, given that such technology does not require the use of fine-motor skills, which the literature frequently reports to be delayed for children with AS.

A fourth goal of this study is to determine whether the combination of the SR accommodation and the SRSD intervention would further improve the fluency, production, and

overall quality of students' written work. It is hypothesized that students with AS will produce lengthier and more complex written work that contain more essential story parts when the SR accommodation is combined with the SRSD writing intervention.

The final goal of this study is to determine whether potential writing skill gains generalized to students' creative writing assignments. It is hypothesized that throughout the course of the study, participants will demonstrate the same writing improvements on homework creative writing assignments as they do in the written work that the accommodation and intervention addressed directly.

Current Findings

Results of this study found that SR was the most effective accommodation in terms of improving writing fluency and story quality when compared to WP and handwriting (HW). Writing accuracy improved for those participants who had more difficulty with spelling. There was very little difference between WP and HW across all variables. When SRSD was then paired with both HW and SR, respectively, the SRSD + SR treatment package resulted in better fluency and story quality, with little additional improvement in accuracy. The SRSD + HW package did not improve fluency or accuracy but, did improve story quality. All findings were generalized to participants' homework creative writing assignments.

Because SR freed participants from having to concentrate on their handwriting, it may have allowed them to concentrate their cognitive resources to produce more accurate and higher quality writing. SRSD alone may address some of the qualitative writing deficits but the addition of SR produced better fluency and story length and was most widely preferred by parents and participants.

CHAPTER II

Literature Review and Rationale

This chapter reviews research examining the development of the diagnostic criteria for AS, its current diagnostic criteria, and the core features of those with AS. A review of the existing literature on the academic profile of the typical student with AS follows, with a specific focus on written language deficits and fine-motor weaknesses that often accompany writing difficulties. The remaining portion of the chapter will examine writing accommodations that the literature frequently recommends for students with AS, followed by a discussion of the SRSD intervention research for students with AS as well as those with writing deficits similar to the deficits exhibited by students with AS.

History of AS and the Development of Diagnostic Criteria

Dr. Leo Kanner, a child psychiatrist at Johns Hopkins University in Baltimore, Maryland, coined the term “infantile autism” in 1943 when he worked with a small group of young children who exhibited self-stimulatory behavior, showed little interest in socializing, and had very substantial speech/language delays (Attwood, 2006). In 1944, an Austrian pediatrician named Hans Asperger, who was reportedly unaware of Kanner’s recent work, was the first to describe what is now known as Asperger’s Syndrome (Ozonoff, Dawson, & McPartland, 2002). Hans Asperger provided an account of four boys who exhibited similar behavioral oddities, motor awkwardness, and socially isolated behaviors often associated with “infantile autism,” yet they were of average intelligence and lacked delays in speech/language development (Khouzam et al., 2004; Klin & Volkmar, 2003). Asperger clarified that, although these children had typically developing speech and language developmental milestones, they tended to demonstrate deficits in nonverbal communication, which typically involved understanding gestures and facial

expressions. He also found that these boys had a tendency to engage in overly formal, one-sided conversations, demonstrating deficits in pragmatic speech and language skills (Klin & Volkmar, 2003). He eventually described these children as having a personality disorder named “autistic psychopathology” (Safran, 2001). Over the next 40 years, Leo Kanner’s work, which focused on lower functioning (i.e., more impaired) individuals on the autistic spectrum, dominated the field while Hans Asperger’s description of individuals who were higher functioning was largely ignored (Attwood, 2006).

In 1981, Dr. Lorna Wing of the United Kingdom re-introduced the disorder now known as AS to the English speaking world in her clinical study of 35 individuals, ranging in ages from 5 to 35 years, who were afflicted with the disorder (Barnhill, 2001; Wing, 1981). In her research, Wing defined several features of AS that included a lack of empathy, the tendency to have one-sided conversations, a poor ability to develop social relationships, pedantic speech, poor non-verbal communication skills, intense absorption in certain special interest areas, and clumsy, stereotyped motor movements (Lee & Park, 2007).

Over the course of the next 13 years, there were a number of clinicians and researchers who proposed various diagnostic criteria characterizing individuals with AS. Although most proposed similar and overlapping features, there were a number of discrepancies that, to date, are the cause of some debate. Prior to its inclusion in the DSM-IV (APA, 1994), Gillberg and Gillberg (1989), Tantam (1988), and Szatmari, Bremner, and Nagy (1989) all proposed their own diagnostic criteria associated with AS, which were the most commonly cited at that time (Lee & Park, 2007). Both Gillberg and Gillberg (1989) and Tantam (1988) list many of the common core features previously noted by Wing in 1981, including motor clumsiness. Szatmari et al. (1989) omitted motor clumsiness as one of the core features of the disorder, which is

commensurate with the criteria later presented in the DSM-IV (APA, 1994). Authors have debated the inclusion of motor clumsiness as a key clinical feature of AS for almost 20 years, although recent research has attempted to better define “motor clumsiness” and awkwardness that some have described anecdotally for years (Rinehart et al., 2006). The fourth edition, text revision, of the *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR*; American Psychiatric Association, 2000) documents the fact that one often observes motor clumsiness, even though it is not a core defining feature, in those with AS.

According to the *DSM-IV-TR*, AS is one of the five diagnoses within the PDD category. These include: Autistic Disorder, Rett’s Disorder, Childhood Disintegrative Disorder, PDD-NOS, and AS. Severe and sustained impairment in social interaction and the development of restricted, repetitive patterns of behavior, interests, and activities characterize AS. Qualitative deficits in social interaction must include two of the following in order to meet criteria: marked impairment in the use of multiple non-verbal gestures/behaviors to establish joint attention, failure to develop age appropriate peer relationships, a lack of spontaneous seeking to share enjoyment with others, and a lack of emotional/social reciprocity (APA, 2000). Stereotyped or repetitive behaviors must include at least one of the following: a preoccupation with a special interest area, inflexible adherence to routines, stereotypical motor movements, and a preoccupation with object details/parts. According to the *DSM-IV-TR*, to meet AS diagnostic criteria, an individual must not have had a significant delay in language or cognitive development, which includes self-help skills, adaptive behavior, and curiosity about the environment within the first three years of life.

There is a clear distinction between children with Autistic Disorder and those with AS, as children with Autistic Disorder must have a clinically significant delay in language skills (APA,

2000). The literature often uses the terms “high functioning autism” and AS interchangeably (Ozonoff et al., 2002). Researchers have attempted to determine whether one can make a distinction between these terms, but current study results suggest that they remain indistinguishable (Manjiviona & Prior, 1995; Szatmari, Burtolucci, & Bremner, 1989). Attwood (2006) prefers the use of the term “high functioning autism” as a diagnostic label due to the lack of training in the diagnosis of AS as well as the possibility that children may receive more intensive services if they have an Autistic Disorder diagnosis, as it has a wider recognition among educators and practitioners.

An Overview of the Core Features of AS

There are three core features that characterize the deficits seen in those with AS: social skills deficits, pragmatic and non-verbal communication deficits, and patterns of restrictive interests and behaviors. Although the *DSM-IV-TR* (APA, 2000) notes and describes these features, researchers have focused on providing a more detailed account of how these specific features reveal themselves in students with AS. In addition to these aforementioned core features, many researchers have explored the relationship of “theory of mind” deficits, or difficulties “reading” the thoughts and feelings of others, with many of the social and academic difficulties experienced by those with AS (Attwood, 2005).

Social characteristics. A child with AS often has a great deal of difficulty initiating and sustaining social interactions, unless the interaction involves the child’s own special interest area (Barnhill, 2001). Children with AS often appear socially stiff and awkward, demonstrating difficulties in picking up on others’ non-verbal social cues, such as reading facial expressions, gestures, and voice tone in a social context (Myles & Simpson, 2002). Although children with AS often express an interest in engaging with and relating to others, they simply lack a social

script and critical understanding of the unwritten rules that underlie social behavior (Myles & Simpson, 2002). As children with AS mature, it becomes more readily apparent that they lack these essential social skills and as a result, may become increasingly stigmatized and rebuffed by their peers (Attwood, 2006). Educators may inadvertently blame students with AS as intentionally misbehaving since they are typically of average intelligence, have rich vocabularies, and should, in a sense, “know better” (Safran & Safran, 2001). In actuality, these students’ difficulties with understanding the intentions, emotions, and perspectives of others as well as their tendency to be socially rigid often interfere with their interactions within the classroom, with both peers and adults (Safran, 2001).

Communication characteristics. Although children with AS do not typically have an overall general delay in language and often exhibit superficially perfect expressive language skills, there are specific language skills that are typically impaired (Attwood, 2006). Pragmatics, the use of language in a social context, is typically an area of weakness for individuals with AS (Church et al., 2000). Impairments in this domain include difficulties initiating and sustaining conversations, difficulties refraining from making inappropriate comments, misinterpretations of literal and implied meanings, pedantic speech, idiosyncratic use of words, and deficits in prosody (Attwood, 2006; Barnhill, 2001a). The latter characterizes what researchers refer to as “odd speech,” which may include abnormalities in inflection, difficulties with voice modulation, and a general lack of variation in pitch, stress, and rhythm (Attwood, 2006). Deficits in pragmatics may substantially interfere with the development of social relationships, as others may see these children as verbally intrusive; disinterested in the interests of others, and tending to speak incessantly about their own special interest areas (Church et al., 2000).

Children with AS also tend to struggle with facets within the non-verbal communication domain that are key to appropriate social interaction. These deficits include the limited use of gestures, clumsy or awkward body language, limited and/or inappropriate facial expressions, or a peculiar, stiff gaze (Barnhill, 2001). Difficulties in non-verbal communication may interfere with the child's ability to understand other people's intentions and feelings, which can become very confusing for a child attempting to understand the social world around him or her.

Special interest areas and rigidity. Studies report that over 90% of individuals with AS have special interest areas, otherwise known as obsessions or circumscribed interests (Attwood, 2003). Children with AS will often tend to obtain a large knowledge base in their preferred specific subject areas, beyond what their typically developing peers may know about those subjects (Myles & Simpson, 2002). Although teachers may sometimes view these special interest areas as an impressive academic strength, intense focus on narrow and specific topics often interferes with successfully engaging with others. For example, students with AS may ask repetitive questions regarding their special interest area in an obsessive manner, have difficulties transitioning to other topics, and often appear to "lecture" about these topics (Williams, 2001).

Rigidity, which typically includes insistence on a set order of events, compulsion to finish what was started, fear or phobia based on a single experience, difficulties deviating from routines, and a regimented insistence on rules also characterize AS (Barnhill, 2001). Children with AS tend to be easily overwhelmed by minimal change and transitions, are highly sensitive to environmental stressors, and may engage in ritualistic behaviors (Williams, 2001).

Theory of mind. Premack and Woodruff (1978) initially coined the term "theory of mind," which refers to the ability to recognize and understand the thoughts, feelings, beliefs, and intentions of others (Attwood, 2005). Also known as "mind reading" or "mentalizing," theory of

mind enables an individual to make sense of and predict other people's behavior (Baron-Cohen, 2001). Recent research has shown that children and adolescents with AS tend to struggle with many behaviors associated with theory of mind deficits. These difficulties include: difficulties reading the social and emotional messages in another person's eyes, the tendency to make literal interpretations, and the tendency to misperceive the intentions of others, which may result in rigid and "self-centered" thought processes (Gately, 2008).

Baron-Cohen suggested that theory of mind deficits contribute to difficulties with imaginative thought, which in turn may interfere with one's abstract comprehension of narrative text. Westby (2004) took Baron-Cohen's work a step further, linking theory of mind deficits to reading comprehension difficulties in children with AS. These difficulties include recognizing and understanding characters' emotional states, determining character goals, and difficulties understanding metaphors, trickery, irony, and sarcasm.

Overview of Academic Problems

There have been very few empirical studies that focus exclusively on academic characteristics of children with AS, even though researchers and educators in the field widely report that these children frequently experience academic problems in the areas of reading comprehension and writing (Myles & Simpson, 2002; Safran, 2005; Williams, 2001). In addition, Prior (2003) summarizes the description of children with AS as unhappy at school, frequent targets of teasing and bullying, and often experiencing conflicts with both teachers and peers. These issues, compounded with their reported academic difficulties, are likely to worsen as students with AS leave the elementary school environment, due to increased variation in routines and daily transitions in middle and high school and because older adolescents may be far less tolerant of their perceived differences (Attwood, 2006). Though it is essential that we

continue to focus on addressing the social deficits that marginalize those with AS, there is emerging evidence that educators may be overlooking specific academic weaknesses, thus causing unrealistic academic expectations to be placed on students with AS (Safran & Safran, 2001). Since students with AS are increasingly educated within general education and integrated classrooms, there is an urgent need to determine how to help them succeed and meet their true potential (Chiang & Lin, 2007a). Given that writing is the primary means by which students demonstrate their learning in school, it is crucial to address this area in particular (Graham & Harris, 2005).

Although there have been numerous studies over the years that have investigated the academic achievement of students on the autistic spectrum, the majority of studies contained participants of various PDD diagnostic categories, without distinguishing between them. For example, one of the most recent studies to examine the patterns of reading ability in children on the autistic spectrum, included children with AS in their sample, but did not look at their skills relative to the other children within the sample who were diagnosed with “autism” or “atypical autism,” which are diagnostic terms that are not synonymous with AS (Nation, Clarke, Wright, & Williams, 2006). To date, there have been only five studies that have examined the academic achievement of children specifically diagnosed with AS, two are qualitative studies (Church et al., 2000; Fondacaro, 2001) and the remaining three are empirical studies, one focusing on all academic areas (Griswold et al., 2002), another specifically focusing on reading skills (Myles, Hilgenfeld, & Barnhill, 2002), and the third specifically describing writing skills (Myles et al., 2003). The following section discusses the latter study, which specifically focused on the writing deficits of students with AS.

Church et al. (2000) conducted a longitudinal review of retrospective educational records of 40 children (39 males, 1 female), ranging from preschool to high school, who had attended a university medical center child development program between 1986 and 1998. In order to be included in the study, all children had meet the *DSM-IV* (APA, 1994) criteria for AS as well as had available or obtainable parent, school, and health care provider information, and the researchers had to have visited each participant on at least two different occasions over the course of the 12-year study. Students' educational records included parent comments and observations, doctors' descriptors, observed child behaviors and interactions, and teacher reports across 12 years for the researchers to use to analyze the data and look for consistencies among students with AS. At the time of the study, all students were at least of high school age or beyond, thus, researchers could obtain a robust amount of information about their elementary school years.

Church et al. (2000) found that by kindergarten, the majority of these children were described as "academically ready," tended to excel in mathematics, were already reading, and possessed good computer skills. As the children progressed through elementary school, most were able to read at several grade levels above their peers. However, reading comprehension eventually became an area of weakness, particularly when reading required inferential reasoning. Researchers also found that handwriting was an important area of weakness for these students, as many wrote slowly and were overly focused on producing a perfect written product. Due to these challenges, educators assigned scribes to several of the children in the study to assist them with their writing.

Fondacaro (2001) was also interested in identifying the specific academic problems that elementary and middle students with AS often exhibit. Fondacaro utilized descriptive qualitative

methods and a series of case studies in order to assess how characteristics of a convenience sample of 12 students (ages 8 – 13 years) with AS may have impacted their academic performance. Fondacaro collected data via standardized open-ended interviews with teachers and providers as well as researchers' observations of the students. Fondacaro then utilized interpretational analysis to identify common patterns and themes in all areas of academic functioning. Similar to Church et al.'s (2000) findings, the author found that 50% of the students exhibited difficulties with reading comprehension and with inferential reasoning. Furthermore, 83% exhibited poor motor skills, with most reporting that they did not like to write. One teacher emphasized that if her student dictated a story, he was able to produce "great sentences," but when required to handwrite the story, he produced "the bare minimum to answer the question" (Fondacaro, 2001, p. 20).

According to the findings of these qualitative studies, children with AS usually initially presented as gifted and exceptionally verbal upon entering elementary school. However, as they progressed through the elementary grades, academic problems began to surface. Specifically, students with AS often struggled with reading comprehension requiring inferential reasoning as well as with writing. Specific writing difficulties seemed to include poor handwriting and slow written production. Compounding these issues is the anecdotal evidence that these children tended to express disdain for the writing process, considering it to be laborious, frustrating, and taxing. Although these studies provide important preliminary descriptive information, they are not quantitative experimental studies. Therefore, these studies are unable to demonstrate whether there are pervasive writing difficulties among the entire AS population or if there are significant differences in written language expression between the AS population, typically performing children, and children with learning disabilities.

To date, Griswold et al.'s (2002) research is the only comprehensive empirically-based study to identify the common academic characteristics of 21 school-aged children with AS, ages 6 to 16. In this study, Griswold et al. individually administered the *Wechsler Individual Achievement Test* (WIAT; Psychological Corp., 1992), the *Test of Problem-Solving-Elementary, Revised* (TOPS-R; Zachman, Barrett, Huisingsh, Orman, & LoGiudice, 1994), and the *Test of Problem Solving-Adolescent* (TOPS-A; Zachman, Barrett, Huisingsh, Orman, & Blagden, 1991). This study provided empirical evidence for the academic deficits described by Church et al. (2000) and Fondacaro (2001), particularly in the areas of inferential reasoning and writing.

On the WIAT, the mean participants' overall total composite score fell within the average range ($M = 97.06$, $SD = 18.81$), although participants' scores showed a great deal of variability. There were no significant differences among specific composite scores (e.g., Reading, Math, Language, and Writing), each of which also fell within the average range, but with large ranges among participants. However, when the authors compared specific subtests, results suggested a significant difference between these students' higher Basic Reading and Oral Expression scores and their lower scores in Numerical Operations and Listening Comprehension, although all were within the average range. The authors removed Written Expression ($M = 90.36$, $SD = 18.90$) from the subtest comparisons, as one student refused to take that particular subtest and four students did not complete the subtest due to fatigue, time constraints, and an inability to reschedule further testing. Griswold and colleagues (2002) indicated that the considerable range of achievement scores among the participants in the study might suggest that one should conduct specific item-analyses of academic skills for each individual student. Furthermore, they stated that results of norm-referenced achievement tests, such as the WIAT, may be misleading, as they may not accurately reflect the specific academic struggles that children with AS seem to be

exhibiting when compared to their peers. The authors suggest that an item analysis of skills, such as might be found using criterion-referenced curriculum based measures, as well as direct observation of students while engaged in academic tasks, would provide a more accurate picture of how the student problem solves and uses his/her reasoning skills.

Griswold et al. (2002) examined the TOPS-R and TOPS-A partially to address the aforementioned limitations of the WIAT and to provide a more comprehensive evaluation of students' strengths and weaknesses related to language-based critical thinking. Specifically, the TOPS-R and TOPS-A examine how a student uses language to make inferences, draws conclusions based on abstract/vague concepts and perspective taking ability. The authors combined students' performance on the TOPS-R/TOPS-A measures ($M = 73.52$, $SD = 17.52$) and found that they were significantly lower than the domain score of the Language Composite of the WIAT ($M = 101.48$, $SD = 18.35$). It is not surprising that students performed more poorly on the TOPS-R/TOPS-A tests as these tests provide a more in-depth examination of how well students make inferences about abstract material, think critically about the material, and understand the intentions/motives of others and present it in written form. Thus, deficits in higher order reasoning skills, which the literature notes throughout (Gately, 2008; Griswold et al., 2002; Myles & Simpson, 2001; Myles & Simpson, 2002; Safran et al., 2003), paired with handwriting fatigue interfered with participants' ability to produce higher qualitatively written work.

Myles et al. (2002) were also interested in exploring the reading comprehension difficulties of children with AS. Myles and her colleagues conducted a study of academic performance by analyzing the reading skills of 16 children with AS, ages 6 to 16 years, using the *Classroom Reading Inventory* (i.e., Silvaroli, 1993), an informal inventory designed to assess various components of reading. Researchers compared differences between participants'

responses to factual/literal questions and inferential questions and found that students correctly answered a significantly higher percentage of factual/literal questions ($M = 60.33$, $SD = 23.69$) than questions requiring inferential reasoning ($M = 38.71$, $SD = 21.98$). Thus, commensurate with other research findings (Church et al., 2000; Griswold et al., 2002), children with AS tended to have difficulty handling material requiring inferential reasoning.

Taken together, these four studies suggest that students with AS exhibit challenges with inferential reading comprehension, writing production, and writing expression. As children progress through elementary school, school curricula increasingly require them to use inferential reasoning skills, language-based critical thinking skills, and produce more fluent and complex written work, yet these are academic areas in which children with AS seem to have the most difficulty. In three (Church et al., 2000; Fondacaro, 2001; Griswold et al., 2002) of the four studies reviewed above, the authors reported writing difficulties. Specifically, these studies found that students with AS struggled with the fine-motor demands of handwriting, writing fluency, and production of more complex written material that required the use of inferential reasoning. Additionally, many students with AS expressed an overall dislike for the writing process, often complaining of fatigue and frustration, and one student even refused to take a writing subtest of a norm-referenced assessment (Fondacaro, 2001; Griswold et al., 2002).

Written Language Deficits for Children with AS

Writing challenges can take several forms, two of which pertain directly to students with AS: handwriting deficits and difficulties with written expression (Myles et al., 2003).

Handwriting problems generally refer to the physical task of writing whereas written expression problems include difficulties with writing fluency, written language complexity, and the overall

quality of the written product. The proceeding subsections describe details pertaining to each type of writing deficit.

Handwriting. Myles and colleagues noted that researchers have only begun to explore the specific fine-motor deficits associated with AS and their implications, which is long overdue given the recognition of this common problem (Ghaziuddin et al., 1994; Gross, 1994; Lopata et al., 2007; Lee & Park, 2007; Reinhart et al., 2006; Winters-Messiers et al., 2007; Winters-Messiers, 2007). Preliminary analyses seem to suggest that fine-motor skill deficits include poor penmanship skills, difficulties mastering pencil grip, and poor motor planning skills (Ghaziuddin, 1994; Lopata et al., 2007; Rinehart et al., 2006).

Myles and her colleagues compared the handwriting skills of 16 typically developing students with 16 students with AS, ranging from ages from 8 to 16 years. According to the results of the *Evaluation Tool of Children's Handwriting* (ETCH; Amundson, 1995), typically developing students produced a significantly higher percentage of legible letters and words, as well as significantly better letter alignment, letter formation, size, and spacing between letters. Results suggested that students with AS had more difficulty with penmanship than their typically developing peers. Previous anecdotal reports (Church et al., 2002; Fondacaro, 2001) that described handwriting challenges for this population support these findings. The authors suggest that these results provide additional evidence that the physical act of writing may be more taxing for students with AS, possibly contributing to their reported disdain for the writing process, thus warranting the use of accommodations such as a WP.

More recently, Fuentes, Mostofsky, and Bastian (2009) found that when compared with their typically developing peers, students with an Autism Spectrum Disorder (which included students with AS) aged 8 to 13 years, had lower overall quality of handwriting, as measured by

the Minnesota Handwriting Assessment (Reisman, 1999). Although they were able to perform similarly to their typically developing peers with respect to letter alignment, spacing, and size, they demonstrated worse letter formation.

Written expression. Preliminary evidence suggests that children with AS tend to struggle with written expression, citing specific weaknesses in writing fluency and written language complexity (Church et al., 2000; Fondacaro, 2001; Ghaziuddin et al., 1994; Gross, 1994; Lopata, Volker, Hamm, & Sowinski, 2007; Myles et al., 2003; Reinhart et al., 2006; Winter-Messiers et al., 2007). Fein and Dunn (2007) suggest that children with AS tend to write simplistic essays and stories that lack a cohesive structure. Consequently, Fein and Dunn suggest that writing products present more like a list of memorized facts than a hierarchically organized paper. The authors indicate that this may reflect the tendency of students with AS to place emphasis on details, without integrating them into larger concepts. Although others have noted these types of problems in the literature (Fondacaro, 2001; Griswold et al., 2002), little reliable empirical evidence has examined these specific writing deficits of children with AS.

In addition to examining handwriting differences, Myles and colleagues compared the written expression skills of typically developing students with those with AS, using the *Test of Written Language* (TOWL-3; Hammil & Larsen, 1996) as well as an informal analysis of the TOWL-3 written language samples. Both groups obtained similar scores on all TOWL-3 subtests, revealing no significant differences. The Griswold et al. (2002) study noted similar findings using standardized measures. However, when Myles and colleagues conducted an informal analysis of the TOWL-3 written language samples to measure sentence complexity, differences between the groups began to emerge.

Typically developing students produced almost twice as many morphemes ($M = 156.06$, $SD = 55.20$), than their peers with AS ($M = 87.25$, $SD = 54.04$), resulting in a significant difference between the two groups ($t(30) = -3.56$; $p < .05$). A morpheme is the smallest meaningful unit in the grammar of a language. For example, the word “dogs” has two morphemes, “dog,” which can stand alone as a noun and “-s,” which is a plural maker on nouns. Similarly, typically developing students generated significantly more t-units (e.g., a minimal unit constituting a complete sentence, consisting of one independent clause and any dependent clauses connected to it which is used as a measure of the structural complexity of sentences; $M = 14.50$, $SD = 5.38$) than their peers with AS ($M = 9.31$, $SD = 5.50$). An example of one t-unit would be “They left early yesterday” and two t-units would be “They left early yesterday, but they decided to stay longer today” as there are two independent clauses strung together in one sentence. Typically developing peers also produced more total words written ($M = 139.25$, $SD = 49.39$) than those with AS ($M = 77.69$, $SD = 47.07$) and had a significantly higher percentage of compound sentences ($M = 17.69$, $SD = 18.71$) than those with AS ($M = 6.19$, $SD = 10.17$). Taken together, these findings suggest that students with AS produced less complex and shorter written products than their typically developing peers. There were no significant differences between the two groups regarding the total number of sentences or on measures tapping conventional writing rules (e.g., grammar, spelling, punctuation).

Suggested Writing Accommodations for Students with AS

Because children with AS often experience writing problems that result from fine-motor difficulties paired with difficulties with writing fluency, sentence complexity, and organization, research examining appropriate accommodations to reduce fine-motor demands and specific writing interventions to facilitate more cohesive and complex written products is necessary.

An accommodation differs from an intervention in that its purpose is not to remediate skill deficits. Accommodations are methods that modify an academic task in order to ameliorate the deficits of those with special needs, who may be at a disadvantage due to their disabilities. Accommodations are typically grouped into four categories: presentation, setting, timing, and response (Cahalan-Laitusis, 2004). Presentation refers to how educators present the material (e.g., Braille), setting refers to changes in the test taker's surroundings (e.g., separate location for testing), timing refers to altering the amount of time for testing (e.g., double time for testing), and response refers to providing alternative options for responding to academic tasks (e.g., use of a WP).

Accommodation research has become exceedingly critical given that the 1997 reauthorization of the Individuals with Disabilities Act (IDEA) that requires that all states to include students with disabilities in their testing practices, with appropriate accommodations (Thurlow et al., 2000). This is an outgrowth of the push for inclusion for students with various disabilities (Thurlow et al.). Unfortunately, it is difficult to determine which accommodations are appropriate for specific populations or types of problems when there is a lack accommodation studies that are specific to high-stakes writing assessments (Cahalan-Laitusis, 2004).

Word processing. Given the limited empirical support for the use of specific writing interventions that educators frequently recommend for students with AS, it is not surprising that educators commonly implement academic accommodations in the classroom to alleviate the frustration often associated with the writing process (Myles et al., 2003). Although assistive technology (AT), such as the use of a WP to complete written assignments, is one of the most widely recommended accommodations for students with AS (Myles et al.), it has yet to be empirically validated for use with this population.

In 1988, Congress passed the Technology-Related Assistance for Individuals with Disabilities Act, which served to increase funding and access to AT and to enhance the skills and competencies of individuals who may benefit from various AT devices (Bryant & Seay, 1998). This legislation was reauthorized in 1994, mandating that research projects funded by the state identify and eliminate systemic barriers that interfere with the timely acquisition of AT devices for individuals with disabilities. Some have speculated that AT may enable students to complete tasks independently and in a more efficient manner (Forgrave, 2002). Research involving AT that is designated for writing has focused exclusively on those typically performing students with writing problems and/or those diagnosed with learning disabilities.

In their review of common accommodation usage in the United States, Thurlow, Lazarus, Thompson, and Morse (2005) note that 39 states allow the use of a WP as a writing accommodation. Thus, its use requires validation for specific populations of those with disabilities (Cahalan-Laitusis, 2004). Although the use of a scribe has empirical support for use with students with learning disabilities (Koretz, 1997; Koretz & Hamilton, 1999, 2000), the use of AT allows the student to be independent and self-sufficient. Various authors have suggested that a WP may be particularly useful for students with AS in order to accommodate their handwriting difficulties (Bryant & Seay, 1998; Church et al., 2000; Fein & Dunn, 2007; Gross, 1994; Manjiviona, 2003; Myles et al., 2003; Myles & Simpson, 2001; Safran et al., 2003). For the student with AS, the use of a WP can support writing in a variety of ways. A WP removes the physical burdens involved in actual print production as well as with revising and editing one's work (Bangert-Drowns, 1993). Secondly, the spell check feature can further support the editing process and provide assistance to those students whose preoccupation with spelling imperfections may negatively impact their ability to express themselves fluently on paper

(Church et al., 2000; MacArthur, Graham, Schwartz, & Schafer, 1995). In order for students to be able to take full advantage of this accommodation, they require practice to attain reasonable typing speed, instruction in how to operate the WP, and access to computers on a regular basis (MacArthur et al., 1995). Although there is no consensus as to what constitutes an appropriate training time period or reasonable typing speed, the authors suggested using a variety of typing programs such as The Milliken Writing Workshop software (1985) to train students to become more proficient with typing.

Several studies have examined the impact of word processing on writing performance with typically performing students, students diagnosed with a learning disability, as well as with students with dysgraphia. Bangert-Drowns (1993) found evidence supporting the use of word processing as an effective testing accommodation via a meta-analysis of 32 studies published between the years 1983 to 1990. Participants in all studies were typically developing students with writing difficulties ranging from elementary to college levels. Findings from the study suggested that students: (a) make more revisions when using a WP, (b) tend to write longer texts, and (c) produce higher quality writing. Of the 20 studies that obtained holistic measures of the quality of student writing, the average effect size was .27, which although small, did favor of use of the WP. Of the five studies that reported document length, the use of a WP significantly increased the number of words written with a medium effect size of .52. There was no effect for writing conventions, such as punctuation and correct grammar usage, or for attitude towards writing, although there was a strong linear relationship between attitude towards writing and writing quality.

Hetzroni and Schrieber (2004) provided further support for the use of a WP as a successful accommodation for three middle school students with dysgraphia. Using a single

subject ABAB design, Hetzroni and Schreiber examined percentage of spelling errors, percentage of errors in the oral reading of final written products, and text structure and organization. The students made fewer spelling mistakes, created better organized written work, used more organization and structure, and made fewer errors when reading their own written work aloud.

Similarly, Lie, O'Hare, and Denwood (1998) found that not only did using a WP produce favorable outcomes, but that teachers and students rated its use as highly acceptable. In their interviews with 51 Scottish students (mean age = 11 years, 8 months) with dysgraphia and their respective teachers about keyboard usage in the classroom, 80% of the teachers reported that their students with dysgraphia benefited from using a keyboard and 70% believed that it increased students' motivation to write. Furthermore, 87% of the students surveyed reported liking the use of a keyboard and felt "empowered" by their written results. Nearly 25% indicated that they no longer experienced writer's cramp and were less likely to feel time pressures to complete their assignments.

In contrast to the aforementioned studies, Hollenbeck, Tindal, Harniss, and Almond (1999) found no significant differences between the use of a WP and handwriting on essay quality produced by seventh grade students with disabilities on an Oregon's statewide test. Hollenbeck and colleagues also compared student performance in the following WP conditions: (a) use of WP for all three days, (b) use of a WP on the last day only, or (c) use of WP on the last day only with access to the spell check feature. Researchers found that the students produced significantly higher quality essays when researchers gave them access to a WP with spell check only on the final day of the exam when compared to students using a WP for all three days. Teachers accounted for these findings by suggesting the latter group best mirrored how they

instructed students in the classroom, initially writing and revising by hand and then producing a final draft on a WP.

MacArthur and Graham (1987) found similar results in their study that compared language complexity (number of words, average t-unit length, vocabulary diversity, proportion of mature words, and proportion of grammatical errors to total words written), mechanical errors, quality and story structure, time and rate measures, and the types of revisions made by 11 fifth and sixth grade students with learning disabilities. Students produced written work via three different modes: handwritten, using a scribe, and using a WP. Researchers found that when students used a scribe, stories were significantly longer, of higher quality, and contained fewer grammatical errors than stories written by hand or with the aid of a WP. There was no difference between handwritten and word processed stories on any of the measures, with the exception of rate of production, favoring handwriting. MacArthur and Graham suggested that their participants were not proficient typers, thus, providing keyboarding support and practice may have improved outcome. Results suggest that the use of a WP in and of itself may not have a major impact on the written language skills of those with learning disabilities, although, commensurate with Lie et al.'s findings, 9 of the 11 students reported that using a WP was "helpful" as it was physically less demanding, neater, and "fun."

Taken together, research supporting the use of a WP to accommodate for writing deficits yields mixed results (Bangert-Drowns, 1993; Cahalan-Laitusis, 2004; Hetzroni & Schreiber, 2004; Hollenbeck et al., 1999; Lie et al., 1998; MacArthur & Graham, 1987). Readers should note that some studies just examined the general writing benefits of using a WP for typically developing children with writing problems (Bangert-Drowns, 1993) as opposed to its use as an accommodation for students diagnosed with dysgraphia. Many studies found that the use of a

WP improved writing fluency, increased the length of written product, provided opportunities to edit and organize written work, and was described as helpful for the writing process. However, other studies found no differences in essay quality between handwriting and the use of a WP (Hollenbeck et al; MacArthur & Graham). Although it appears that there are benefits to using a WP, it remains unclear as to whether this type of accommodation can actually address all of the writing difficulties experienced by those with differing levels of writing deficits. Notable was the study by MacArthur and Graham whose findings suggest that perhaps WP is an appropriate accommodation to address the physical demands of writing but does not improve written expression.

SR technology. Although not specifically recommended for students with AS, speech recognition (SR) technology has garnered some empirical support as an effective writing accommodation for students with writing deficits and learning disabilities (MacArthur & Cavalier, 2004). The SR research has typically focused on students (with and without a learning disability classification), who have difficulties with the conventions of writing (e.g., spelling, grammar), noteworthy problems with handwriting, and difficulties with writing fluency and organization. Although students with AS do not typically require the assistance with the conventions of writing, they do require assistance with handwriting and the more qualitative aspects of writing (Griswold et al., 2002; Myles et al., 2003). SR technology enables a writer to speak into a microphone attached to a computer, which then transforms oral language into a written product. There are a variety of SR systems, but all share common features. All SR systems require that the writer “train” the software for a few hours in order to allow the computer to accurately recognize the full range of the writer’s speech patterns. However, as SR technology has improved with time, training time has decreased substantially (De La Paz, 1999). All SR

technology has error-correction features, which allow speakers to edit and correct their text after production (De La Paz). MacArthur & Cavalier (2004) report the accuracy rate for current SR software to be between 90% and 98% for adult speakers. Despite improvements, MacArthur and Cavalier warn that users must still articulate clearly, dictate punctuation and formatting, and try to avoid extraneous vocalizations.

SR is similar to WP in that it addresses difficulties with the physical demands of writing (Fondacaro, 2001; Ghaziuddin et al., 1994; Gross, 1994; Lopata, Volker, Hamm, & Sowinski, 2007; Reinhart et al., 2006; Winter-Messiers et al., 2007). Also, both accommodations provide the students a visible representation of the developing text, providing opportunities to better organize their writing as they compose, which researchers also frequently cite as a weakness for those with AS (Church et al., 2000; Myles et al., 2003). However, since SR does not require a grapho-motor component and assumes speech articulation processes to be highly automatized in most people, SR eliminates the probability of transcription errors that may occur with handwriting or using a WP (Quinlan, 2004). De La Paz (1999) noted that by composing orally, students can better focus on planning and generating meaningful content, rather than having to place additional attention and cognitive resources to the mechanical demands of handwriting or typing. Furthermore, she suggested that the burden of handwriting or typing one's thoughts may interfere with higher-order skills (e.g., planning, organization, and content generation), which are often found to be challenging for students with AS (Church et al., 2000; Myles et al., 2003).

Since the development of the more advanced SR systems, two studies have utilized this more updated and efficient technology to explore the potential benefits of its use as a writing accommodation for students with writing difficulties (MacArthur & Cavalier, 2004; Quinlan, 2004). In their study, MacArthur and Cavalier explored the effectiveness of SR technology with

31 high school students with and without learning disabilities. Using a repeated measures design, all students wrote essays in the following three conditions: handwritten, dictation to an adult scribe, and the use of SR technology (i.e., Dragon Naturally Speaking, Version 4, 1998). Students' mean accuracy level when using SR was 87%, which led researchers to conclude that SR technology was a feasible writing accommodation to use with the adolescent population. The use of a scribe resulted in the highest quality essays, followed by those written using SR. Both AT conditions were significantly better than the handwriting condition in terms of quality ratings. There were no significant differences in vocabulary diversity or length of written product across conditions.

Quinlan (2004) also investigated the use of a more recent version of Dragon Naturally Speaking (2002) SR technology and its potential impact on writing fluency for children ages 11 to 14 years. Participants included 21 "less fluent" writers and 20 "fluent" writers, who produced narratives using both handwriting and SR technology. The researchers were also interested in whether the addition of an advanced planning component based on the SRSD writing intervention (Graham & Harris, 1989) would produce even more favorable outcomes when combined with SR. Without advanced planning, less fluent writers produced significantly fewer words and more errors in the handwriting condition when compared to SR. However, there were no significant differences in the quality ratings for either condition. When the authors introduced the graphic organizer component, less fluent writers produced significantly higher quality writing in both conditions, and overall the combination of SR and advanced planning yielded the best outcomes.

Based on the results of the two preliminary studies, the use of SR yields promising findings. SR appears to increase story length, reduce errors, and generally produce higher quality

writing for those with writing difficulties (MacArthur & Cavalier, 2004; Quinlan, 2004). Interestingly, the effects of SR were improved when researchers trained students to plan their writing first using the SRSD graphic organizer. This suggests that combining a writing accommodation with an intervention may produce the best results for children who struggle with writing fluency. Writing accommodations can only partially address the fine-motor problems and handwriting deficits often experienced by those with AS. Their difficulties organizing their thoughts and writing a fluent and more complex written product require an intervention and their frequently reported disdain for the writing process needs to be addressed through that particular intervention.

Writing Interventions

Although AT accommodations can effectively ameliorate writing problems associated with handwriting, less evidence has found these tools useful for addressing written expression challenges (Berninger et al., 2008; Hollenbeck et al., 1999; MacArthur & Graham, 1987). This was particularly notable when Quinlan (2004) found that use of a specific writing intervention enhanced the use of SR technology. Furthermore, in her research with children with reading and writing disabilities, Berninger and colleagues (2008) indicated that accommodations are often necessary, but seldom sufficient, to handle the escalating writing demands placed on students as they progress through their middle and high school years. She too stated the necessity of pairing accommodations with specific writing instruction to produce the best ultimate outcomes.

Possible recommendations to facilitate writing improvements in children with AS are consistent with those offered to any student with writing challenges (Safran et al., 2003). That being said, there is a paucity of research on effective writing interventions. Fortunately, the extant research supports one multi-faceted writing strategy, Self-Regulated Strategy

Development (SRSD), which Graham, Harris, MacArthur, and Schwartz (1991) developed. The goals of SRSD are to: (a) assist students with planning, production, revision, and editing of their written work; (b) help students further develop the capability to monitor and manage their writing; and (c) aid students in developing positive attitudes towards the writing process (Graham & Harris, 2005). Graham et al. designed the intervention to promote students' independent use of specific strategies and facilitate self-regulation and self-monitoring of the use of these strategies (Graham & Harris). SRSD accomplishes these goals by teaching the elements of good story writing, modeling and scaffolding self-instruction techniques, as well as the use a graphic organizer.

Because the SRSD intervention is a treatment package, it is able to target many of the writing deficits of students with AS (Asaro & Saddler, 2009). Research has consistently demonstrated that the SRSD intervention can improve the quality of writing, writing fluency, writing self-efficacy, and motivational dispositions, all of which represent skills that are impacted in students with AS (Graham & Harris, 2003; Graham & Harris, 2005; Harris, Graham, & Mason, 2003). Specifically, SRSD may be well suited to address the theory of mind deficits exhibited by those with AS, as the graphic organizer contains questions to help students generate characters' potential thoughts and feelings, which may not come naturally for those with AS. SRSD instruction teaches students to elaborate on their initial writing sample and focus on determining each character's goals (e.g., "What does the main character do or want to do?"), another area of weakness associated with theory of mind deficits.

The following steps comprise the SRSD intervention (Harris et al., 2003):

1. Teacher and student work together to develop background knowledge and pre-skills, such as vocabulary (e.g., setting, character) needed for strategy use. The teacher also begins to

help the student develop personal positive self-statements to help motivate and guide him/her through the writing process.

2. Teachers teach and discuss specific strategies. This includes the use of the POW mnemonic (e.g., Plan what to say, Organize what to say, Write and say more) and the WWW graphic organizer (e.g., a list of 7 questions such as “Who is the main character” and “When does the story take place”) detailing the various components of a good story.
3. The teacher then models the strategies and use of self-statements during the writing process.
4. The student memorizes the strategies and the teacher continues to scaffold student’s strategy usage.
5. The student transitions to independent performance.

Graham and Harris (2003) conducted a meta-analysis of SRSD studies. In their review of 26 studies published from 1985 to 2002, Graham and Harris found large average effect sizes ranging from 1.47 for quality, 1.78 for story elements, and 2.00 for length and story grammar scores, suggesting that SRSD has a strong and positive effect on the critical aspects of students’ writing. The authors also found medium to large average effect sizes among various writing parameters after studies removed SRSD, thereby suggesting the maintenance of the impact of the intervention on writing. The authors noted that average writing quality effects were larger for younger students (grades 2 - 6), when compared to students in grades 7 and 8, but that effects for composition length were stronger for the older group.

There have been a number of studies published since Graham and Harris conducted their meta-analysis in 2003. Saddler, Moran, Graham, and Harris (2004) also studied the effects of SRSD instruction with six second graders with writing difficulties. Saddler et al. found that the

SRSD intervention increased the length of stories, improved their quality, and resulted in written products that contained a greater number of key story elements. The SRSD intervention explicitly teaches the latter variable and it refers to the seven common elements that a good story should include (Graham & Harris, 2003). Saddler (2006) replicated the study with another group of second graders with learning disabilities who had substantially lower reading and writing skills, as measured by the Woodcock-Johnson Tests of Achievement-III (WJ-III; Woodcock, McGrew, & Mather, 2001). As seen in the initial study, with the SRSD intervention, students wrote higher quality stories and subsequently increased the number of key story elements and total words written. Saddler found mixed maintenance results, as students generally maintained their gains in the number of story elements, but the number of words per story decreased for all but one student. Half of the participants maintained quality gains.

Some researchers have studied the effectiveness of the SRSD intervention with students with ADHD and accompanying writing difficulties. Reid and Lienemann (2006) used a multiple baseline design across participants to determine the effect that the SRSD intervention had on three third and fourth grade students' writing quality, completeness, and length. The authors also had their participants consistently graph and self-monitor their performance (e.g., number of words written). Findings reveal that the SRSD intervention had an immediate and pronounced effect on the quality of writing, the number of words written, and the number of story parts gleaned from the WWW graphic organizer that they included in their stories. De La Paz (2001) found similar results in her multiple-probe design across three middle school students with ADHD, in which students made better plans before writing, and the quality, length, and structure of their written products improved after SRSD instruction. Students maintained results at a month following the study.

Lienemann, Graham, Leader-Janssen, and Reid (2006) and Lane et al., (2008) produced similar findings, but with different populations. Lienemann and colleagues evaluated the effectiveness of the SRSD writing intervention for six second grade students' who were at-risk for writing failure. Using a multiple baseline design across participants, the authors were also interested in writing quality, completeness and length. Researchers found that the SRSD intervention increased the number of total words written, the number of story elements included in their stories, and, with the exception of one student, were considered qualitatively better. These findings were generally maintained over time. Lane and colleagues found the same results for six second grade students with behavioral and writing difficulties, although researchers paired the SRSD intervention with a positive reinforcement system in which a student would earn tickets for successful completion of writing lessons. Results revealed lasting improvements in story completeness, number of words written, and in the quality of written product.

To date, there have been two published studies and one dissertation that examined the effectiveness of the SRSD intervention on improving the writing skills of students with AS. Delano (2007) combined the SRSD intervention with video self-modeling for three adolescents with AS, measuring its potential impact on the number of words written and number of functional essay elements. Delano videotaped the participants during SRSD training and asked them to chart their own progress. She edited verbal prompts out of the videotapes and later played them for the participants prior to each intervention session. In a multiple baseline design across responses (e.g., total words written and functional story elements), Delano found that the SRSD package substantially increased the number of words written for all participants and two of the three participants wrote for longer periods of time. In addition, each student demonstrated gains in the number of functional essay elements. Although this study demonstrates the potential

usefulness of the SRSD intervention for students with AS, its inclusion of the video self-modeling and goal setting components make it difficult to determine whether SRSD would be as effective on its own as it is when combined with these other interventions.

Asaro and Saddler (2009) also found positive results in their study examining the effectiveness of the SRSD intervention on the overall quality and number of story elements for a 10-year old male with AS. The participant wrote higher quality stories with an increase in total number of story parts, the latter being consistent with Delano's outcome. Asaro's (2009) dissertation focused on three young students, one of whom had a diagnosis of AS and the other two had diagnoses of autism. They made similar improvements in overall quality and number of story elements but also increased the total number of words written after being given the SRSD lessons.

SRSD has proven to be an effective intervention for students who struggle with the writing process, regardless of the type of disability. Preliminary evidence suggests that this strategy is also effective to address the multi-faceted written expression problems observed in students with AS. For example, the aforementioned research demonstrated that the SRSD intervention improves the quality and complexity of children's writing, the length of the written product, and the number of essential story elements that comprise a cohesive story. Furthermore, SRSD may enhance AT accommodations that address the physically demanding nature of writing by also improving the process and planning of writing for students with AS. This notion is consistent with suggestions by researchers (e.g., MacArthur, 2000; Berninger, 2008) who have recommended that AT be paired with specific writing instruction to improve the quality of writing as well as the mechanics. MacArthur and Hollenbeck et al. (1999) conclude that a

computer accommodation alone will not likely address the more complex writing issues that students with writing disabilities frequently face in the classroom setting.

Summary and Rationale for Research

A review of the literature reveals that children with AS tend to struggle with writing. Specifically, they tend to produce less complex written work than their typically developing peers, evidence handwriting deficits, have difficulties with organization and fluency, and frequently express frustration/disdain for the writing process (Church et al., 2000; Myles et al., 2003). It appears that these writing challenges may fall into two categories that one can describe as fine-motor difficulties and written expression problems (Ghaziuddin et al., 1994; Gross, 1994; Lopata et al., 2007; Lee & Park, 2007; Reinhart et al., 2006; Winters-Messiers et al., 2007; Winters-Messiers, 2007). Given this, it may be that educators need different types of strategies to address these multifaceted problems. Although word processing may alleviate the physically demanding nature of writing, it likely does not address the skills needed to compose a fluent, cohesive, and complex written product. SR provides an interesting option to this problem as it appears not only to eliminate the physical demands of writing but it may also enhance some parts of written expression such as fluency and story quality. That being said, the combination of the SR accommodation with an intervention that specifically targets written expression challenges, such as the SRSD, may produce the most successful outcomes for these students (MacArthur, 2000; Quinlan, 2004).

Hypotheses

I designed this dissertation to answer three questions. First, I was interested in determining which of two frequently used, albeit not empirically demonstrated, writing accommodations (e.g., WP or SR accommodation) would be more successful for improving the

written language fluency and production for students with AS. Total words written (TWW), number of words in a complete sentence (WCS), percentage of correct word sequences (%CWS), and number of story parts assessed written language performance. TWW is a general measure of writing fluency and production and WCS, which is only moderately correlated with TWW ($r(527) = .36, p < .01$), taps a more specific component of writing fluency that focuses on complete/correct sentences (Gansle, 2006). Thus, I believed that WCS would be a good measure to assess potential improvements in t-unit production (Myles et al., 2003). Tindal and Parker (1989) have demonstrated that the %CWS measure is highly correlated with teachers' holistic ratings of writing, thus it served as a measure of overall story quality. The number of story parts assessed story cohesiveness and completeness (Delano, 2007; Lienemann et al., 2006; Reid & Lienemann, 2006).

Secondly, this study examined whether the introduction of a specific writing intervention (SRSD) would have an additive effect on the improvements in written language performance, particularly with overall quality and story completeness. Finally, this study examined whether writing improvements generalized to participants' creative writing homework assignments, which I collected and measured throughout the study.

Based on the literature review, this dissertation investigated the following research hypotheses:

HO1: Participants with AS will increase TWW and WCS when provided with the SR writing accommodation when compared with handwritten work and work that they produce using a WP, given that there are no fine-motor demands in its implementation.

HO2: Participants with AS will demonstrate significant increases in TWW, WCS, %CWS, and number of story parts beyond those produced by each of the

accommodations alone when the SRSD writing intervention is subsequently paired with the SR writing accommodation, demonstrating improved overall quality of the written product.

HO3: The written language improvements, as measured by the four dependent writing variables, will be generalized to creative writing assignments collected over the course of the study.

CHAPTER III

Method

This chapter provides a description of the participants, recruitment procedures, setting, materials/measures, interventions, and procedures.

Participants

Four students with AS, selected from grades 4 - 6, participated in this study. I selected these grade level parameters since previous SRSD research had used these grade levels with the specific SRSD graphic organizers and methods proposed in this dissertation (Graham & Harris, 2003). In single-subject research, it is customary to include between 3 and 8 participants in a single study (Horner et al., 2005). I selected the participants based on the following criteria: (a) formal diagnosis of AS, provided by a licensed psychologist, pediatric neurologist, developmental pediatrician, or psychiatrist; (b) school record of consistent underachievement in the area of writing, based on parent report; and (c) basic skill and knowledge in using a WP, which was determined by a preliminary typing test assessing the student's typing proficiency; and (d) parental consent and student assent. The first four participants who qualified for the study and provided consent and assent were chosen to participate.

I contacted a psychologist from a large urban city who currently runs after-school social skills groups for children and adolescents with AS in order to recruit potential participants from her groups. In addition, I contacted school psychologists from the same urban city's public school system via letter to assist with recruitment (see Appendix A). If school psychologists had a student in their school that they believe met the requirements of the study, they sent home a parent recruitment letter (see Appendix B) and a parent consent form (see Appendix C). The recruitment letter asked parents to contact me for additional information if they were interested

in having their child participate in the study. The letter included self-addressed stamped envelopes along with the consent form and parent recruitment letter.

When a parent contacted me and expressed interest in having his or her child participate in the study, I set up a convenient time and place to meet with the parent and child. At that meeting, I obtained official consent from the parent(s) and sought formal assent from the child (see Appendix D).

I selected the four males who met the aforementioned criteria to participate in this study. Abe and Cal were in the 4th grade, Bob was in 5th grade, and Dan was in 6th. All participants resided in middle class neighborhoods and received special education services through the Committee on Special Education in the same large urban school system. Abe, Bob, and Cal were all of African American decent and were in Collaborative Team Teaching classes that are co-taught by a special education teacher and a general education teacher. These three participants also received occupational and speech therapy. Abe was also assigned a one-on-one paraprofessional and had weekly group counseling sessions. Dan, who was of Caucasian decent, was a student in a specialized program, which caters to students with AS. This program is similar to the Collaborative Team Teaching program because students with AS are integrated with general education students in a classroom taught by a special education teacher and a general education teacher, but the students with AS have a curriculum specific to their sensory, behavioral, and academic needs. Dan also received occupational and speech therapy.

Occupational therapy is often provided to students who may require additional support in strengthening fine-motor weakness associated with handwriting as well as with improving muscle coordination, motor control, and endurance (The American Occupational Therapy Association, Inc.). It should be noted that all participants had been receiving occupational

therapy for at least three years on a twice weekly basis yet continued to struggle with the physical demands of handwriting. Although occupational therapists often consider the need for assisted technology for their students, particularly for those who have on-going handwriting deficits, these participants did not currently receive any assistive technology writing accommodations.

Setting

I conducted the study in the students' homes after school hours. The study consisted of 15-22, 30-minute sessions for the training, baseline, and intervention. Many other SRSD studies used 30-minute sessions (Asaro & Saddler, 2009; Lane et al., 2008; Saddler, 2006), thus I believed it would be an adequate amount of time and would prevent fatigue. I implemented interventions in an area of the home where the participants typically completed their school assignments. I made sure that there was ample space for both me and the participant and that the area was free from distraction.

Materials

In addition to the materials used for the study, I used a protocol detailing training procedures as a script for each participant. The basic materials required for the study included pencils, lined wide ruled writing paper (8 ½" x 11") and printer paper, and a stopwatch.

WP accommodation. Participants used the WordPad program on my laptop computer to write their stories. This program does not make editing corrections, thus the participant were not prompted to make changes as they type. The computer is a SONY VAIO brand laptop, with the following dimensions (13" x 9" x 1.5"). In addition, I used a reading passage from the book *Dolphins and Sharks* (Osborne & Boyce, 2003) for the procedure to assess typing proficiency

(Langone, Levine, Clees, Malone, & Koorland, 1996). I chose this book since it is simplistic and below the participants' grade level.

SR accommodation. I downloaded the SR software, Dragon Naturally Speaking Preferred, 10th version (2008), onto my laptop computer. The SR software enables the participants to tell their stories orally into the computer's microphone, rather than writing it by hand or using a keyboard.

SRSD training and intervention. This included a chart that listed the self-statements that the participant generated with me, a WWW graphic organizer (See Appendix E) that listed the seven questions for participants to answer in order to produce a good story, and three sample stories for training purposes (see Appendices F, G, & H).

Intervention Rating Profile-15 (IRP-15; Witt & Elliot, 1985). Participants' parents completed this measure of social validity to determine how they rated the appropriateness, reasonability, fairness, and usefulness of the interventions used in this study (see Appendix I). The IRP-15 was slightly modified to ensure that questions were pertinent for parents, which has been done in a number of studies (Fiala & Sheridan, 2003; Williams, 2006). For example, the question "I would be willing to use _____ in the classroom setting" was modified to "I would be willing to use _____ when helping my son with his homework." Because the literature indicates that parents and teachers frequently state that their children with AS dislike writing, this measure helped determine the extent to which the interventions alleviated these negative feelings (Church et al., 2000; Fondacaro, 2001).

Children's Intervention Rating Profile (CIRP; Turco & Elliot, 1985). Participants completed a measure of social validity designed specifically for children (see Appendix J). This measure addressed the frequently reported disdain for the writing process.

Preliminary Typing Test

Prior to inclusion, all participants took a typing test. I selected a reading passage from the book *Dolphins and Sharks* (Osborne & Boyce, 2003) from *The Magic Tree House* series, with a Spache Readability Index of 3.48 (OKAPI), which is below actual grade level for all the participants. Participants first read the typing test passage aloud to ensure that the 3rd grade level reading passage was not too difficult for them and that they performed at least on a 3rd grade mastery level. I chose the 3rd grade level since it is below all of the participants' actual grade levels and I believed that they could focus on copying the passage if they could read it fluently rather than having to spend additional time decoding difficult words. Each participant read the passage for one minute and I recorded the number of words read correctly and incorrectly. According to Hasbrouk and Tindal's oral reading fluency norms (2006), a 3rd grade mastery level is 137 words correctly read per minute (WCPM). Abe, Bob, Cal, and Dan read 144, 138, 140, and 185 WCPM; thus, the reading passage was sufficient to assess typing proficiency for each participant.

The participants then typed the passage onto my laptop computer. Since there is no general consensus on what constitutes "proficient" typing speed for children (Langone et al., 1996), I considered participants proficient for this study if they were able to type at least 10 words per minute. Langone et al. used this criterion in a study that compared word processing and handwriting in third through fifth grade students with behavior disorders. In keeping with Langone et al.'s procedures, the participants had three minutes to type the passage presented to them and I recorded the number of words typed per minute.

The results of the preliminary writing test revealed that all participants typed at least an average of 10 words per minute, indicating sufficient typing proficiency for this study (Langone

et al., 1996). Abe and Cal typed 30 words in 3 minutes (10 words per min), Bob typed 31 words (10.3 words per min), and Dan typed 33 words (11 words per min).

Curriculum Based Measurement (CBM)

Most of the research that examined the writing deficits of those with AS (Griswold et al., 2002; Myles et al., 2003) reported that the use of norm-referenced, standardized tests were insufficient to accurately assess the specific writing deficits exhibited by that particular population. Since educators are not able to use standardized, norm-referenced measures of achievement to frequently assess and monitor student academic progress and standardized achievement measures may not be closely linked to classroom instruction, researchers developed CBM to serve this purpose (Shinn, 1989). CBM is a brief, direct, and objective measure of written expression that utilizes material from the student's curriculum and that educators can administer on an on-going basis to measure progress (Shinn). Consistent progress monitoring has become increasingly important for educators and school administrators due to the current accountability demands of the No Child Left Behind Act of 2001, as well as the trend to provide evidence that a student is or is not responding to a particular intervention (McMaster & Espin, 2007).

CBM is a reliable and valid measure for written expression. Criterion validity has been established for total words written, words spelled correctly, and correct letter sequences with the following standardized writing assessments: Test of Written Language (TOWL), the Developmental Scoring System (DSS), the Stanford Achievement Test (SAT), and the SAT Language subtest, with correlation ranges from $r(23) = .41$ to $r(76) = .84$, $p < .05$ (Gansle et al., 2002; Marston, 1989). One can divide CBM for written expression into two different types of measures, those that measure writing fluency (e.g., production-dependent) and those that

measure writing accuracy (e.g., production-independent). Production-dependent measures include total words written (TWW), words spelled correctly, correct letter sequence, correct word sequences, complete sentences, and words in complete sentences (WCS). Of these, evidence suggests that TWW and WCS belong to two distinct clusters within the production domain; TWW corresponds with general production and WCS with a complete and/or correct sentence production cluster. Furthermore, Gansle et al. (2006) found these two measures to be only modestly ($r(527) = .36, p < .01$) correlated. Studies have shown production-independent measures, such as percentage of words spelled correctly, percentage of legible words, and percentage of correct word sequences (%CWS), to be more strongly correlated with teachers' holistic ratings of sixth through eighth grade students' writing than production-dependent measures, with ranges from $r(164) = .42$ to $r(164) = .75, p = .20$. (Tindal & Parker, 1989).

I used the following four variables to assess writing skills in the present study: TWW, WCS, %CWS, and number of story parts.

TWW. I counted the total words written during the 3-minute writing period, including titles and words spelled incorrectly. Numbers that were not spelled out were not counted as words (Shinn, 1989). Research has found that for third through sixth graders, TWW has medium to large criterion validity with the TOWL ($r(23) = .41$ to $r(23) = .82, p < .001$), SAT ($r(23) = .57$ to $r(23) = .81, p < .001$), *Woodcock-Johnson-Revised Writing Samples Subtest* ($r(39) = .23, p = .13$), Developmental Scoring System ($r(76) = .65$ to $r(76) = .74, p < .001$), *Stanford-9* ($r(527) = .34, p < .01$), and the *Wisconsin Knowledge and Concepts Examination (WKCE)* ($r(183) = .26$ to $r(183) = .28, p < .001$) (Deno, Mirkin, & Marston, 1980; Gansle et al., 2006; Weissenburger & Epsin, 2005). TWW has also demonstrated good test-retest ($r(527) = .80$) and inter-scorer reliability with 97.7 % agreement (Gansle et al., 2006).

WCS. WCS is the total number of words written in each complete sentence during a 3-minute writing period, including titles and words spelled incorrectly. A sentence is complete if it starts with a capital letter, has a recognizable subject, includes a verb, and has ending punctuation. Numbers that are not spelled out were not counted as words (Gansle et al., 2002). Studies found WCS to be significantly correlated with the *Iowa Test of Basic Skills* ($r(160) = .34, p < .005$), the *Stanford-9* ($r(527) = .41, p < .01$) and the *Woodcock-Johnson-Revised Writing Samples Subtest* ($r(39) = .35, p < .05$) for third and fourth grade students and WCS showed great promise in predicting adequate writing fluency skills (Gansle et al., 2002; Gansle et al., 2004; Gansle et al., 2006).

%CWS. I computed the number of correct word sequences by counting the number of two consecutive words joined together that are spelled correctly and are grammatically correct (e.g., correct word sequences) and dividing that score by the sum of the correct and incorrect word sequences to obtain a percentage (Shinn, 1989).

Number of story parts. I computed the total number of common functional story elements gleaned from the WWW graphic organizer. The seven possible story elements included: main characters, locale, time, what the main characters want to do, what they did, how they felt, and how the story ends (Graham & Harris, 1989). I counted the total number of elements for each story written. A number of studies have used this measure to examine the effectiveness of the SRSD intervention (Asaro, 2009; Asaro & Saddler, 2009; Delano, 2007; Lienemann et al., 2006; Reid & Lienemann, 2006) for improving quality of story content (Graham & Harris, 1989).

Independent Variables

WP accommodation. Participants used the WordPad program on my laptop computer to write their stories, with the spell check component disabled.

SR accommodation. I downloaded the SR software, Dragon Naturally Speaking Preferred, 10th version (2006), onto my laptop computer. The SR software enables the participant to tell his/her story orally into the computer's microphone, rather than writing it by hand or using a keyboard. Each participant completed a training session, which involved reading a series of training passages into the microphone of the computer; so that the SR software learned the participants' specific speech patterns and subsequently created a voice file for each individual. I sat next to the participant to ensure that he was enunciating clearly and reading each word of the passage. The software then translated the participant's words onto the computer screen in order to be viewed. The participant could use the SR software to orally execute other demands, such as moving the cursor to the next line, moving the cursor to the end of the paragraph, and capitalizing words.

SRSD intervention. I introduced the SRSD intervention (Graham & Harris, 2005) in two training sessions in which I taught the individual participants to generate and utilize self-statements. These self-statements were intended to help the participants monitor and manage their writing. I then taught participants the POW and WWW strategies, which eventually became the basis of their graphic organizers.

Research Design and Analysis

The study used a multiple phase alternating treatments design with a final treatment phase (Rosenberg, 1986; Scott, Glynn, & Ballard, 1988) to compare the initial handwriting condition, WP accommodation, and the SR accommodation on the dependent measures. The alternating treatments design can be very useful in determining the relative effectiveness of multiple interventions and it does not require the withdrawal of a treatment to demonstrate that a functional relationship exists (Richards, Taylor, Ramasamy, & Richards, 1999). The design

involves the rapid alternation of two or more interventions over time within a single subject (Barlow & Henson, 1984). Two important aspects of this design are that the interventions be counterbalanced and that the participants should be able to distinguish between interventions (Richards et al., 1999). The researcher makes decisions through visual inspection of data (explained below) to determine whether there is a clear difference between the treatments.

Variability, or stability, of data refers to fluctuations in the participants' performance. Baseline data should be stable, thus representing the natural occurrence of behavior, and should not vary more than 50% from the mean of the baseline in order for the investigator to initiate the treatment phase (Barlow & Henson, 1984). For the current study, I collected baseline data until they were stable and contained at least five data points (Alberto & Troutman, 2003), after which I initiated the initial intervention phase.

One defines treatments in alternating treatments designs as differentiated if their data separate vertically from one another without overlapping for a series of data points (Alberto & Troutman, 2003). Current recommendations are that data collection include at in least four data points for each condition (Horner, Sugal, Swaminathan, & Smolkowski, 2008) and be discontinued when the most effective treatment is stable with 80-90% of the data points falling within its mean (Alberto & Troutman, 2003) and treatments show differentiation.

In order to strengthen the case for demonstrating a functional relationship between an intervention and its impact on the target behavior, an alternating treatments design can include a replication phase. Following the alternating treatments phase, a replication phase continues the most effective treatment for a series of data points, which provides evidence that one treatment is associated with proposed behavioral change (Alberto & Troutman, 2003; Richards et al., 1999). In this dissertation, a replication phase followed both alternating treatment phases.

Inter-observer Agreement and Procedural Integrity

A trained school psychology doctoral student scored 30% of the participants' written work, a customary figure (Magee & Ellis, 2000; Rehfeldt & Chambers, 2003; Smith, Daunic, & Taylor, 2007), in order to determine inter-observer agreement. I gave the doctoral student the protocol (see Appendix K), a procedural integrity checklist (see Appendix L), and an audiotape of the sessions in order to determine procedural integrity during the training session for each of the participants. During the intervention phases, the doctoral student listened to the audiotape of 30% of each participant's sessions to ensure that I had followed the intervention protocol in the same manner for each participant. The procedural integrity checklist clearly defined each step during baseline, training, and intervention sessions. I calculated procedural integrity by dividing the number of steps correctly completed by the total number of steps on the checklist.

Procedures

I exposed each participant to five experimental phases and a generalization phase. The phases included: initial baseline, alternating treatments (HW, WP, and SR), replication of the most effective treatment, a second alternating treatments phase (SRSD + handwriting and SRSD + SR), and the replication of the most effective treatment.

Phase 1 – Initial baseline. I provided participants with a pencil and sheets of lined wide ruled paper. I utilized a list of story starters (Shapiro, 2004), which research commonly uses to prompt a student to produce a written story based on the topic sentence provided. I then gave participants the following directions:

Here is a pencil and some sheets of paper for your writing. I want you to write a story. I am going to read a sentence to you first, and then I want you to write a story about what happens. You will have one minute to think about the story you will write and then have

three minutes to write it. Please do your best work. If you don't know how to spell a word, you should guess. Are there any questions? For the next minute, think about (insert story starter). Begin writing (Shinn, 1989).

If the participant discontinued writing prior to 3 minutes, I encouraged him to continue writing. At the end of 3 minutes, I stated "stop and put your pencil down." I collected baseline data on the four dependent variables for at least five sessions and until baseline data were stable.

Phase 2 – Alternating treatments (HW, WP, and SR). I alternated administration of three interventions (i.e., HW condition, the WP accommodation, and the SR accommodation) with each participant. Prior to data collection, I utilized two additional sessions to train the participants on SR technology. This training involved having the participant read the two training stories into the microphone and completing the software's training session to create an individual voice file.

Following SR training, I counterbalanced three treatment conditions by placing three slips of paper in a hat containing the words "WP," "SR" and "HW" and the participant drew slips before each session. The order in which the participant selected the slips of paper indicated the order of the treatments during the session. The participant was only asked to write a maximum of three stories in one session to prevent fatigue. I then gave the following instructions, which I had modified from Shinn (1989), to participants:

I want you to compose a story. I am going to read a sentence to you first, and then I want you to compose a story about what happens. You will either hand write the story, use the keyboard, or tell your story into the microphone, depending on the paper you chose from the hat. You will have one minute to think about the story you will write and then have three minutes to compose it. Please do your best work. If you don't know how to spell a

word, you should guess. Are there any questions? For the next minute, think about (insert story starter). Begin composing your story.

Between each intervention, the participant was given a 5-minute break period in which he engaged in a puzzle activity in order to alleviate potential fatigue. I used different story starters for each intervention in each session. This alternating treatments phase continued until I identified the most effective treatment by calculating the TWW, the primary measure. Based on this variable, I implemented the most effective treatment alone in a replication phase. I then calculated the WCS, %CWS, and number of story parts to determine whether the treatments effect those variables.

Phase 3 – Replication of the most effective treatment. I continued the most effective accommodation (SR) for two sessions in order to better demonstrate a functional relationship between the accommodation and increase in TWW, using the same procedures listed in phase 2.

Phase 4 - Alternating treatments (SRSD + HW and SRSD + SR). Prior to data collection, I provided participants with SRSD training, divided into two 30-minute sessions. The SRSD + HW treatment combined the SRSD intervention and the HW condition. The participants used the SRSD intervention strategies, including the list of self-statements, the written POW strategy reminder, and their respective WWW graphic organizers, to write their stories using pencils and lined paper. The SRSD + SR treatment combined the SRSD intervention and the SR accommodation. The participants followed the same procedure as the SRSD + HW treatment, but orally narrated their stories into the computer's microphone, using the Dragon Naturally Speaking Preferred, 10th version (2008) SR program.

The SRSD training phase included the following steps for the first training session:

1. Teaching the participants to make positive self-statements such as “I can do this if I use my strategies and take my time.” I gave participants the following instructions:

Sometimes when we write, we get “stuck.” I would like to help you think of some things that you can say to yourself when this happens. Here is a piece of paper with the following incomplete statements “To think of good ideas I could,” “While I work I could,” and “To check my work I could.” What can be good thing to say to yourself to help you think of good ideas? (the participant was then encouraged to think of at least two self-statements and record on sheet. If the participants were unable to think of self-statements, they were provided the example “Take my time and a good idea will come to me.”). What can you say to yourself while you work? (I encouraged participants to think of at least two self-statements and record. If the participant was unable to think of a self-statement, I provided the participant with the example “Slow down and look at my WWW chart for help”). What can you say to yourself when you are checking your work? After the participants complete the self-statements worksheet, I told them, “Now that you have your self-statements, let’s put them on the desk so you can look at them while you work.”

2. I then taught participants the POW and WWW strategies, which became the basis of their graphic organizers. I used these strategies to guide the participant before, during, and after completion of the written product. I then told the participants the following:

I am going to teach you some tricks for writing. First we’re going to learn the POW strategy, or trick, that good writers use when they write. POW stands for “pick my idea, organize my notes, and write and say more.” One way you can remember POW is that it

gives you power when you write. Before you begin your writing, POW can help remind you about the steps in good writing.

3. The study used the WWW strategy as a graphic organizer that contains seven key questions designed to assist the participants with organizing their writing. These questions are: “Who is the main character?”, “When does the story take place?”, “Where does the story take place?”, “What does the main character do or want to do?”, “What do the other characters do?”, “What happens then?”, “What happens with the other characters?”, “How does the story end?”, “How does the main character feel?”, and “How do the other characters feel?” I told the participants the following:

Let’s find out what the parts of a good story are. Here is a list of important questions you should answer to help organize your writing after picking your idea (I placed the WWW graphic organizer in front of the participant). I am going to read a story called ‘The Tiger’s Whiskers’ to find out if the writer used all of the parts of a good story (I then gave the participant a copy of the story). Listen carefully.

I read two sample stories (“The Tiger’s Whiskers” and “Albert the Fish”) to the participants and demonstrated and modeled the use of self-statements and the POW and WWW strategies for participants.

The second training session began with my modeling for the participant how to use the various strategies to create a story. I gave the following directions to the participant:

Now I am going to show you how we can use our strategies to write a good story. I will write a story and show you how I use the strategies and then you will write a story on your own. Before I begin writing, I am going to put the self-statements, my POW reminder, and my WWW chart on my desk. Here is my story starter “One day, I opened

up my front door and a little rabbit was sitting on the door mat.” Well if I look at my POW reminder, I know I have to pick my idea. I think I will write about a girl being excited about finding the rabbit and try to figure out if it’s missing. Now I have to organize my ideas with my WWW chart (the chart will be filled out with the same information across participants). Now that I filled out my WWW chart, I am ready to write my story. While I write, I am going to look at my self-statements if I get stuck. Since I have organized my notes, I am ready to write (I pointed to the POW reminder). Here I go. I am going to place a check next to the question when I’ve answered it in my story (I spoke aloud as the story is written).

After modeling the story writing process, I gave participants an opportunity to practice their strategies using three story starters. They received the following directions:

Here is a pencil and some sheets of paper for your writing. I want you to write a story. I am going to read a sentence to you first, and then I want you to write a story about what happens. Please fill out your WWW chart, look at your self-statements and POW reminder if you get stuck. After you fill out your WWW chart, you should begin writing your story. Do your best work and if you don’t know how to spell a word, you should just guess. I am here to help you if you forget how to use your strategies. Here is your story starter: “This weekend I am going to a birthday party.” Place your self-statements, POW reminder, and WWW chart on your desk and begin.

Following SRSD training, I gave participants their respective lists of self-statements generated during the training phase. I placed these self-statements on a plastic book holder to the left of the participant. I then gave participants a blank WWW graphic organizer that contained the seven questions. At that time, I alternated two treatments, SRSD + HW and SRSD + SR.

During this phase, the participants no longer received prompts and guided practice and participants utilized the SRSD materials independently. The two treatment conditions were counterbalanced by placing two slips of paper in a hat containing the words “SRSD + HW” and “SRSD + SR” and participants drew them before each session. The order in which participants drew the slips of paper indicated the order of the treatments during the session and I ensured that there was no administration of any one treatment for more than three consecutive times (Barlow & Henson, 1984). Participants received the following instructions:

I want you to write a story. I am going to read a sentence to you first, and then I want you to write a short story about what happens. Please put your self-statements, your POW reminder and WWW chart on your desk. Don't forget to use your POW reminders and self-statements if you get stuck. When you are finished filling out your WWW chart, state “I'm done.” At that time, I will let you know when you could begin writing your story. You will either be writing your story using pencil and paper or by talking into the microphone, depending on the piece of paper you chose from the hat. You will have 3 minutes to write your story. Do your best work and if you don't know how to spell a word, you should guess. Are there any questions? (If the participant discontinued writing before the three minutes have elapsed, I encouraged him to continue writing. After 3 minutes, I stated “stop.”

In keeping with procedures from the first alternating treatments phase, I determined the most effective treatment by calculating the TWW.

Phase 5 –Replication of the most effective treatment. The most effective treatment continued by itself for two sessions, using the same procedures listed in phase 4.

Phase 6 – Generalization. I used classroom homework writing assignments during the first alternating treatment phase and the second alternating treatment phase to determine whether gains made throughout the study were generalized to actual classroom assignments. In keeping with the scoring procedures of this study, I scored only the first three minutes of writing.

Based on the literature review, I predicted that the SR accommodation would most successfully increase TWW when compared to the HW and WP conditions. When the researcher subsequently paired SR with the SRSD intervention, TWW was expected to increase further. The following figure on depicts the expected outcome of the study (Figure 1).

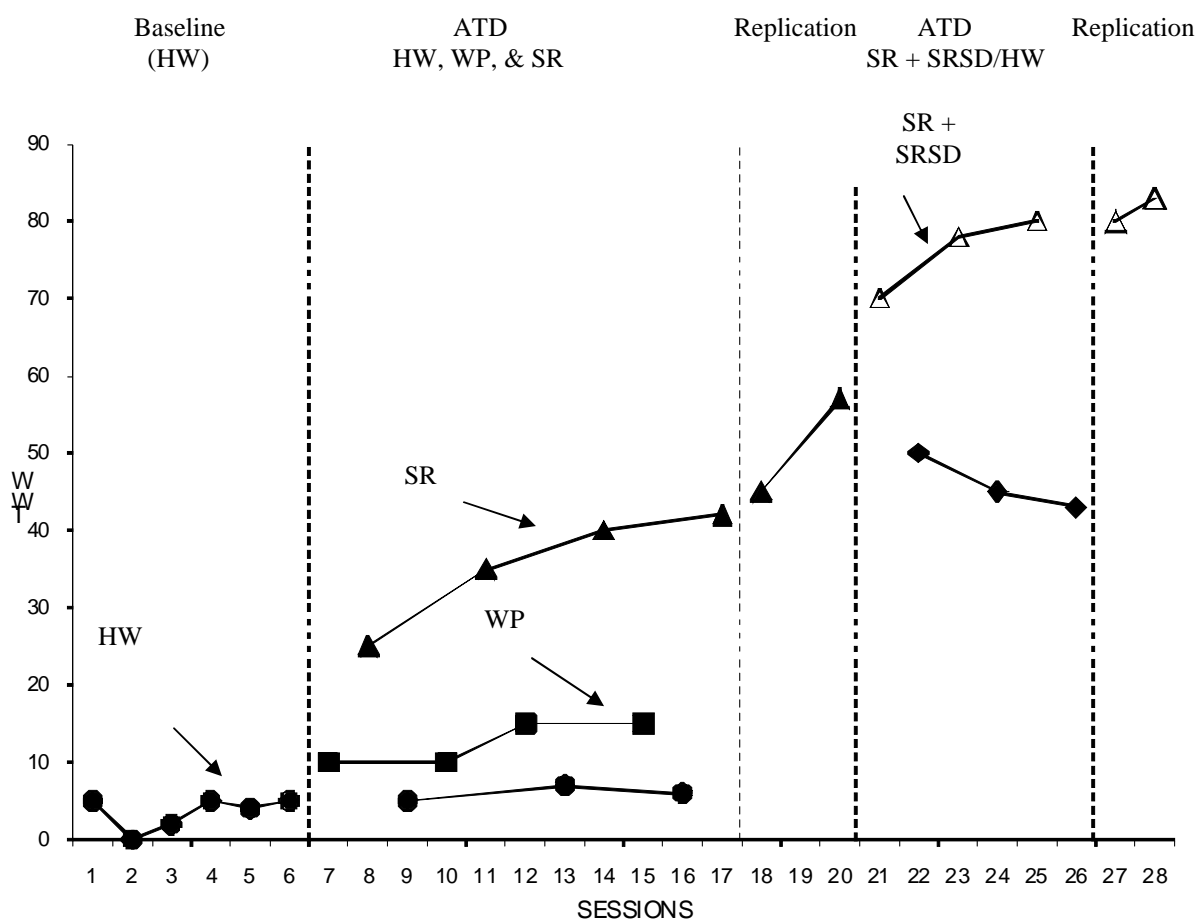


Figure 1

Expected Outcome of Study

Social Validity

Treatment acceptability is the degree to which an individual perceives a specific intervention as appropriate, reasonable, fair, and useful (Sterling-Turner & Watson, 2002). In this present study, the participants' parents completed the *IRP-15* (Witt & Elliot, 1985) to assess their perceptions about each of the two writing accommodations and the SRSD intervention. The *IRP-15* is a 15-item questionnaire that focuses on various aspects of the intervention utilized and asks that the respondent rate items on a 6-point likert scale, ranging from 1 (*strongly disagree*) to 6 (*strongly agree*) (Witt & Elliot, 1985). Overall scores range from 15 to 90, with higher scores reflecting greater acceptability of the treatment.

The *IRP-15* has high internal consistency, with a Cronbach's alpha of .98 (Witt & Elliot, 1985). In addition, the *IRP-15* has good construct validity supporting the general acceptability measure, as Martens et al. (1985) found that the *IRP-15* was significantly negatively correlated ($r(51) = -.86, p < .001$) with the evaluative factor of the *Semantic Differential* (*SD*; Osgood, Suci, & Tannebaum, 1957), another measure utilized to assess affective responses. The negative correlation resulted because the positive ratings on the *SD* receive a lower rating than negative ones, which is the inverse of items on the *IRP-15*. I modified the items of this measure slightly to reflect the interventions in this present study and to make it more suitable for parents. For example, the statement "The _____ would be an acceptable intervention for managing classroom behavior" became "The _____ would be an acceptable intervention for improving writing skills."

The participants in this study completed the *CIRP*, a treatment acceptability rating measure specifically designed for children (Witt & Elliot, 1985). The *CIRP* consists of seven statements written at a fifth grade level that asks the participant to rate the fairness, expected

effectiveness, and potential negative outcomes of each of the accommodations and interventions used in the study (Finn & Sladeczek, 2001). The participants rated the seven items on a 7-point likert scale, ranging from 1 (*disagree*) to 6 (*agree*), with higher scores corresponding to higher treatment acceptability.

The *CIRP*'s internal consistency ranges between Cronbach alphas of .75 and .89 (Elliot, Witt, Galvin, & Moe, 1986; Turco & Elliot, 1986; Witt & Elliot, 1985). Construct validity evidence is promising but limited, as the *CIRP* was significantly correlated ($r(178) = .67, p < .001$) with the *Treatment Expectancy Scale (TES)*; Waas & Anderson, 1991), a measure of treatment outcome expectancy for school-based treatments developed by Waas and Anderson, which they have yet to validate.

Chapter IV

Results

This chapter will briefly review the research questions and then discuss procedural integrity and inter-scorer agreement. This will be followed by data analysis and a final section on social validity. I intended to first determine whether participants would have visually higher TWW and WCS scores (according to trend and level changes between phases) when using SR compared with HW and WP. Secondly, I hypothesized that participants would demonstrate increases in TWW, WCS, %CWS, and number of story parts beyond those produced by each of the accommodations alone when the most effective treatment (i.e., HW, WP, or SR) was paired with the SRSD intervention. Lastly, I hypothesized that any gains in all four dependent variables made with the interventions implemented would be generalized to participants' creative writing homework assignments collected over the course of the study.

Procedural Integrity

An independent observer, a trained doctoral student, assessed procedural integrity during 33%, 30%, 31%, and 33% of the sessions for Abe, Bob, Cal, and Dan, respectively. This independent observer listened to the audiotapes while utilizing the protocol containing the oral instructions presented to participants (see Appendix K) and a procedural integrity checklist (see Appendix L) to determine whether I followed the same procedures for all participants. The checklist contained the following sections: (a) typing test, (b) baseline, (c) alternating treatments (HW, WP, and SR), (d) replication (HW and SR), (e) SRSD training session #1, (f) SRSD training session #2, (g) alternating treatments (HW + SRSD and SR + SRSD), and (h) replication (SR + SRSD). Each section clearly defined the steps required to follow according to the protocol. The independent observer was required to place a checkmark next to each step performed

according to protocol while listening to audiotaped sessions. The number of steps checked by the observer was divided by the total number of steps listed on the procedural checklist and then multiplied by 100. Procedural integrity across audiotaped sessions was 100% for all participants.

Inter-Scorer Agreement

A trained doctoral student independently scored each writing probe to assess inter-scorer agreement for TWW, WCS, %CWS, and number of story parts. The doctoral student was given the specific scoring guidelines for each dependent variable and asked to record his calculations in order to compare with the researcher's initial calculations. Total score comparisons made between the doctoral student and the researcher were calculated for TWW, WCS, %CWS, and number of story parts across 32% of writing probes for Abe, Cal, and Dan and 30% of Bob's writing probes. Agreement was calculated by dividing the total number of agreement scores by the total number of agreement scores plus total disagreement scores and multiplying by 100. For dependent variables, inter-scorer agreement was 100% for TWW and WCS, 93.0% for %CWS, and 93.0% for number of story parts. Inter-scorer agreements for Abe, Bob, Cal, and Dan were 97.7%, 95.0%, 95.8%, and 97.1%, respectively.

Baseline (HW)

I collected baseline data for Abe and Dan for 5 sessions, Bob for 8 sessions, and Cal for 9 sessions. Tables 1 – 4 (pp. 63, 69, 75, and 81) present descriptive statistics for baseline, both alternating treatment (ATD) phases, and their respective replication phases. Baseline data sessions varied for each participant as it took longer for some participants to reach stability across five data points.

TWW served as the primary dependent variable, illustrating writing fluency, and will be discussed first. This variable provides a general assessment of overall writing fluency (i.e. how

quickly the participant can write) but does not include the accuracy aspects of writing such as grammar, spelling, and the basic conventions of writing (Gansle et al., 2006). Figure 2 (Panels 1 – 4, pp. 64 - 67) presents the TWW results for each participant and reveals that baseline responding was stable (see Table 1, p. 63) but well below normative scores for all participants as spring TWW norms are 41.40 ($SD = 12.90$) for 4th graders , 46.40 ($SD = 13.60$) for 5th graders, and 53.30 ($SD = 15.40$) for 6th graders (Shinn, 1989).

Table 1
Mean Total Words Written

| Participants | <u>Baseline</u> | | <u>HW</u> | | <u>WP</u> | | <u>SR</u> | | <u>Replication</u> | | <u>SRSD+HW</u> | | <u>SRSD+SR</u> | | <u>Replication</u> | |
|--------------|-----------------|-------------|-----------|-------------|-----------|-------------|-----------|---------------------|--------------------|-------------|----------------|-------------|----------------|-------------|--------------------|-------------|
| | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> |
| Abe | 24.00 | (2.36) | 22.20 | (1.92) | 19.80 | (1.30) | 41.00 | (1.58) | 44.33 | (4.16) | 22.20 | (2.17) | 54.25 | (3.30) | 60.00 | (4.24) |
| Bob | 22.75 | (1.75) | 24.25 | (1.83) | 19.62 | (2.39) | 47.28 | (2.63) ^a | 52.50 | (0.71) | 25.50 | (3.00) | 56.25 | (1.50) | 58.50 | (2.12) |
| Cal | 21.89 | (1.97) | 25.50 | (0.58) | 16.75 | (0.96) | 55.50 | (5.07) | 56.50 | (0.71) | 25.75 | (1.26) | 65.50 | (2.38) | 68.50 | (3.54) |
| Dan | 22.80 | (2.17) | 27.25 | (4.03) | 32.75 | (2.18) | 66.50 | (1.73) | 67.00 | (1.41) | 25.75 | (2.22) | 76.75 | (2.50) | 81.00 | (7.07) |

Note. ^a Mean *and* *SD* without outlier. With outlier, *M* = 51.25, *SD* = 11.47

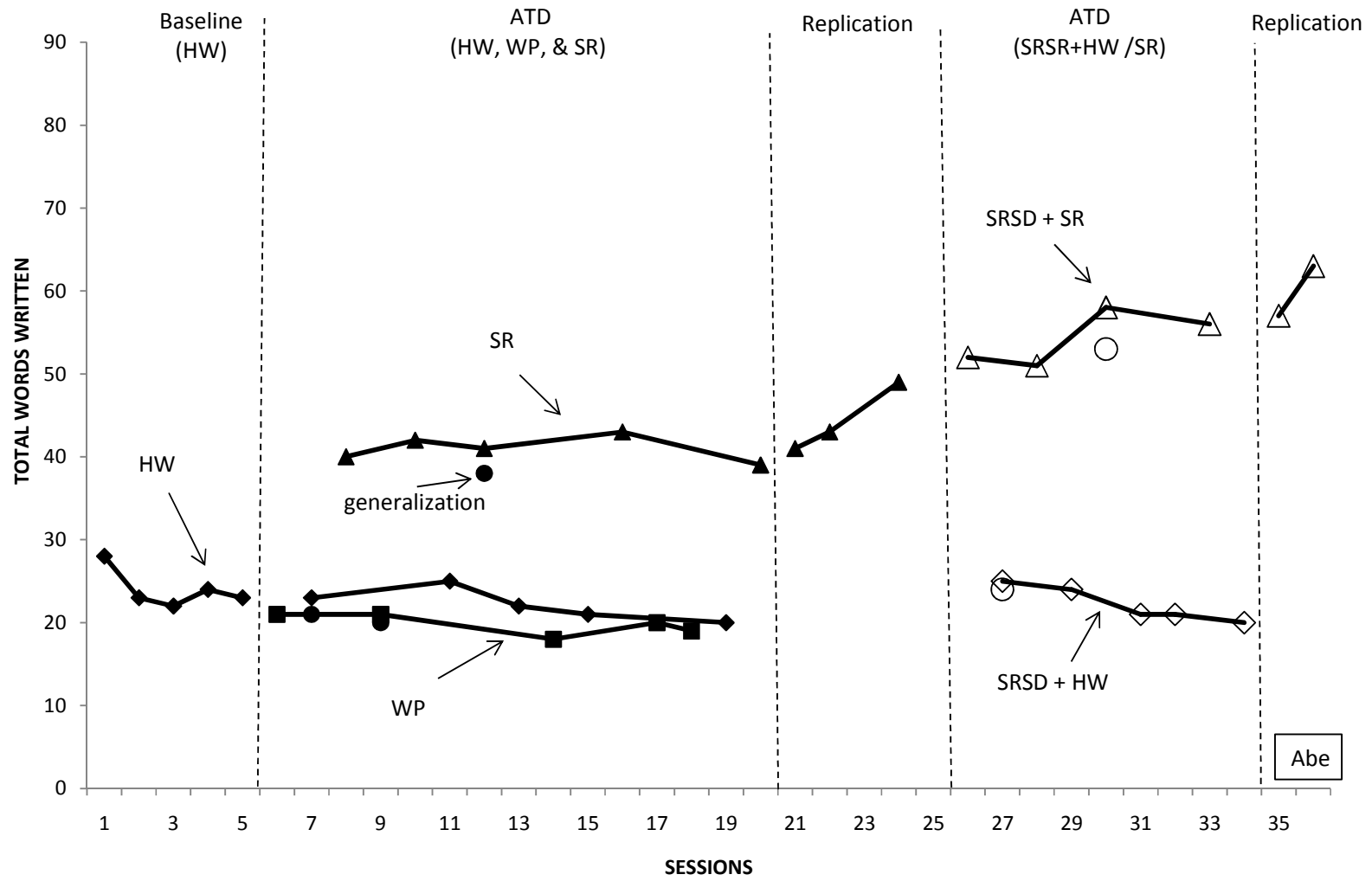


Figure 2 (panel 1). Total number of words written

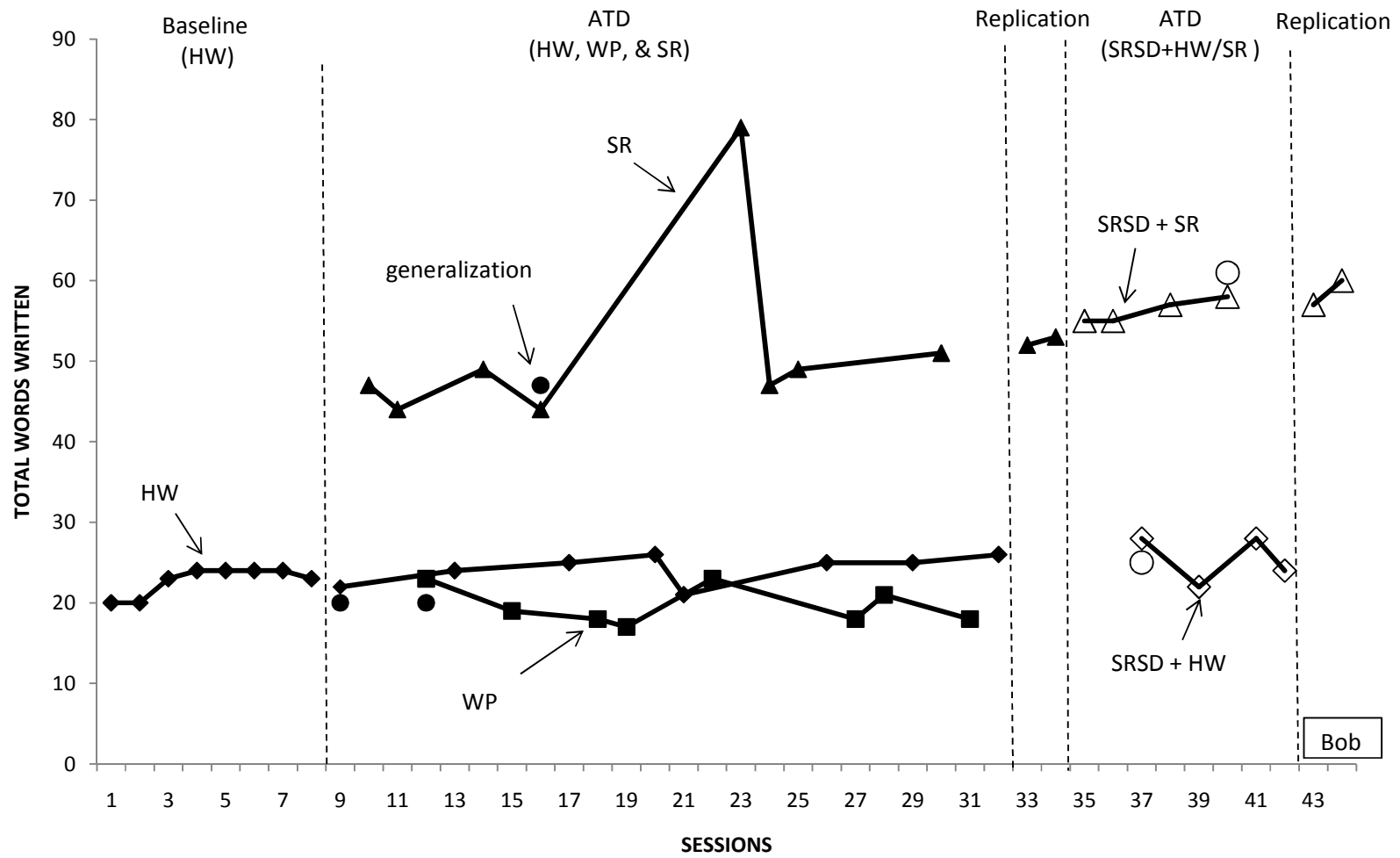


Figure 2 (panel 2). Total number of words written

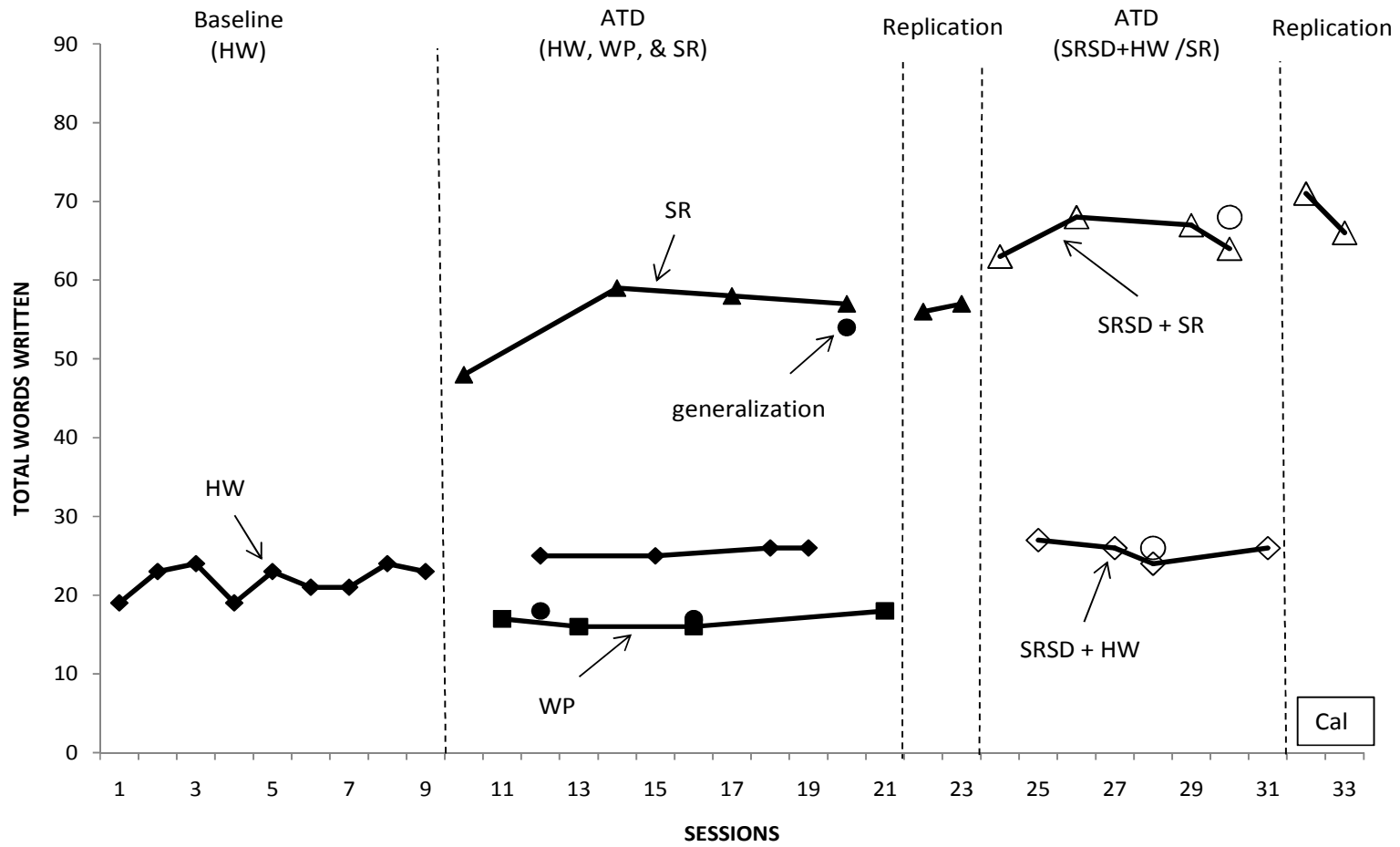


Figure 2 (panel 3). Total number of words written

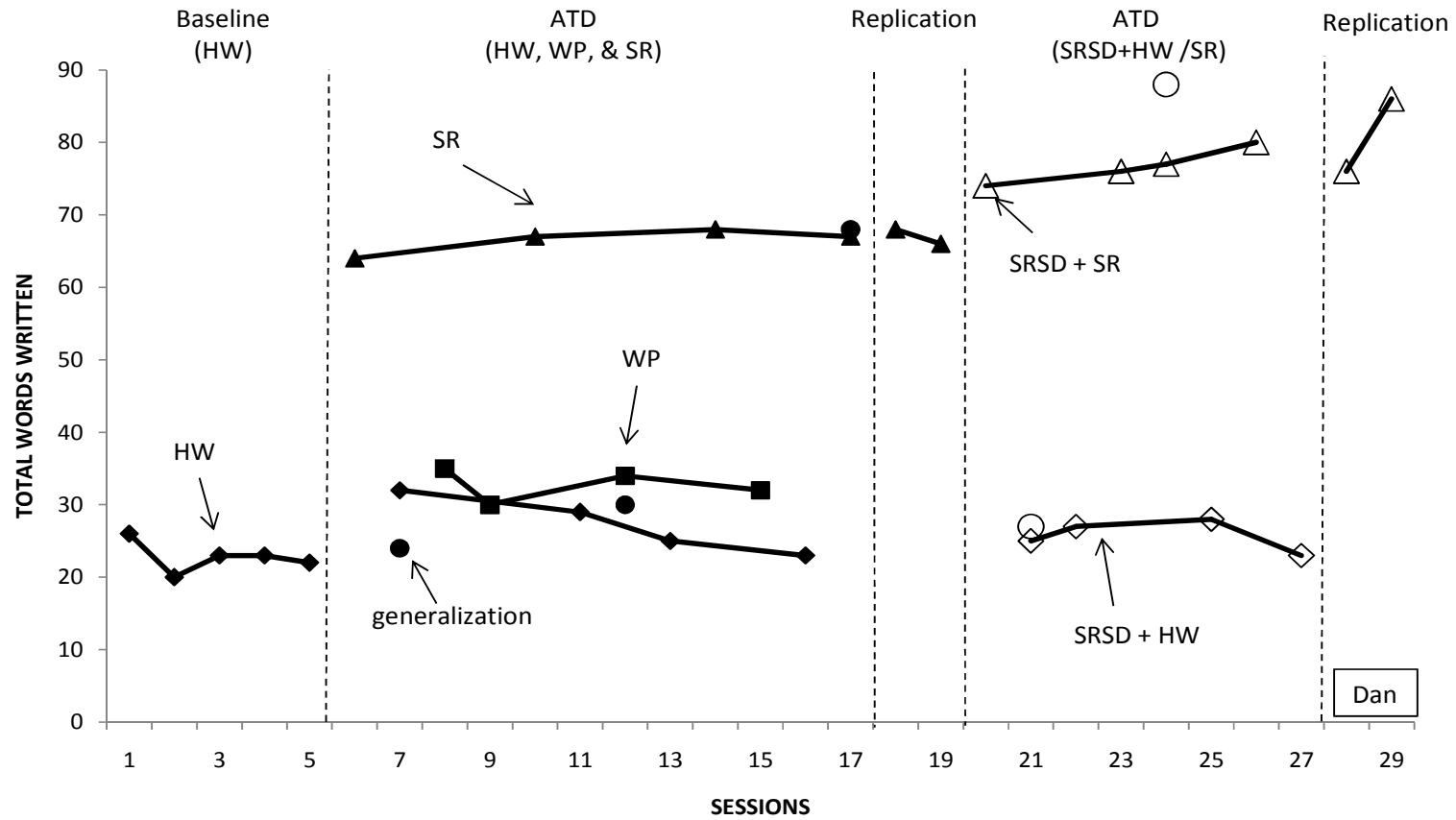


Figure 2 (panel 4). Total number of words written

WCS is another measure of writing fluency but differs from TWW in that there is a focus on writing in complete sentences. This means students begin each sentence with a capital letter, include a noun and verb, and use appropriate ending punctuation marks (Gansle, 2006). Table 2 (p. 69) lists all participants' WCS normative scores and standard deviations and Figure 3 (Panels 1 – 4, pp. 70 - 73) displays the WCS for all participants and reveals identical outcomes to TWW.

Table 2
Mean Words in Complete Sentences

| Participants | <u>Baseline</u> | | <u>HW</u> | | <u>WP</u> | | <u>SR</u> | | <u>Replication</u> | | <u>SRSD+HW</u> | | <u>SRSD+SR</u> | | <u>Replication</u> | |
|--------------|-----------------|-------------|-----------|-------------|-----------|-------------|-----------|---------------------|--------------------|-------------|----------------|-------------|----------------|-------------|--------------------|-------------|
| | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> |
| Abe | 24.00 | (2.36) | 22.20 | (1.92) | 19.80 | (1.30) | 41.00 | (1.58) | 44.33 | (4.16) | 22.20 | (2.17) | 54.25 | (3.30) | 60.00 | (4.24) |
| Bob | 22.75 | (1.75) | 24.25 | (1.83) | 19.62 | (2.39) | 47.28 | (2.63) ^b | 52.50 | (0.71) | 25.50 | (3.00) | 56.25 | (1.50) | 58.50 | (2.12) |
| Cal | 21.89 | (1.97) | 25.50 | (0.58) | 16.75 | (0.96) | 55.50 | (5.07) | 56.50 | (0.71) | 25.75 | (1.26) | 65.50 | (2.38) | 68.50 | (3.54) |
| Dan | 22.80 | (2.17) | 27.25 | (4.03) | 32.75 | (2.18) | 66.50 | (1.73) | 67.00 | (1.41) | 25.75 | (2.22) | 76.75 | (2.50) | 81.00 | (7.07) |

Note. ^b Mean and SD without outlier. With outlier, *M* = 51.25, *SD* = 11.47

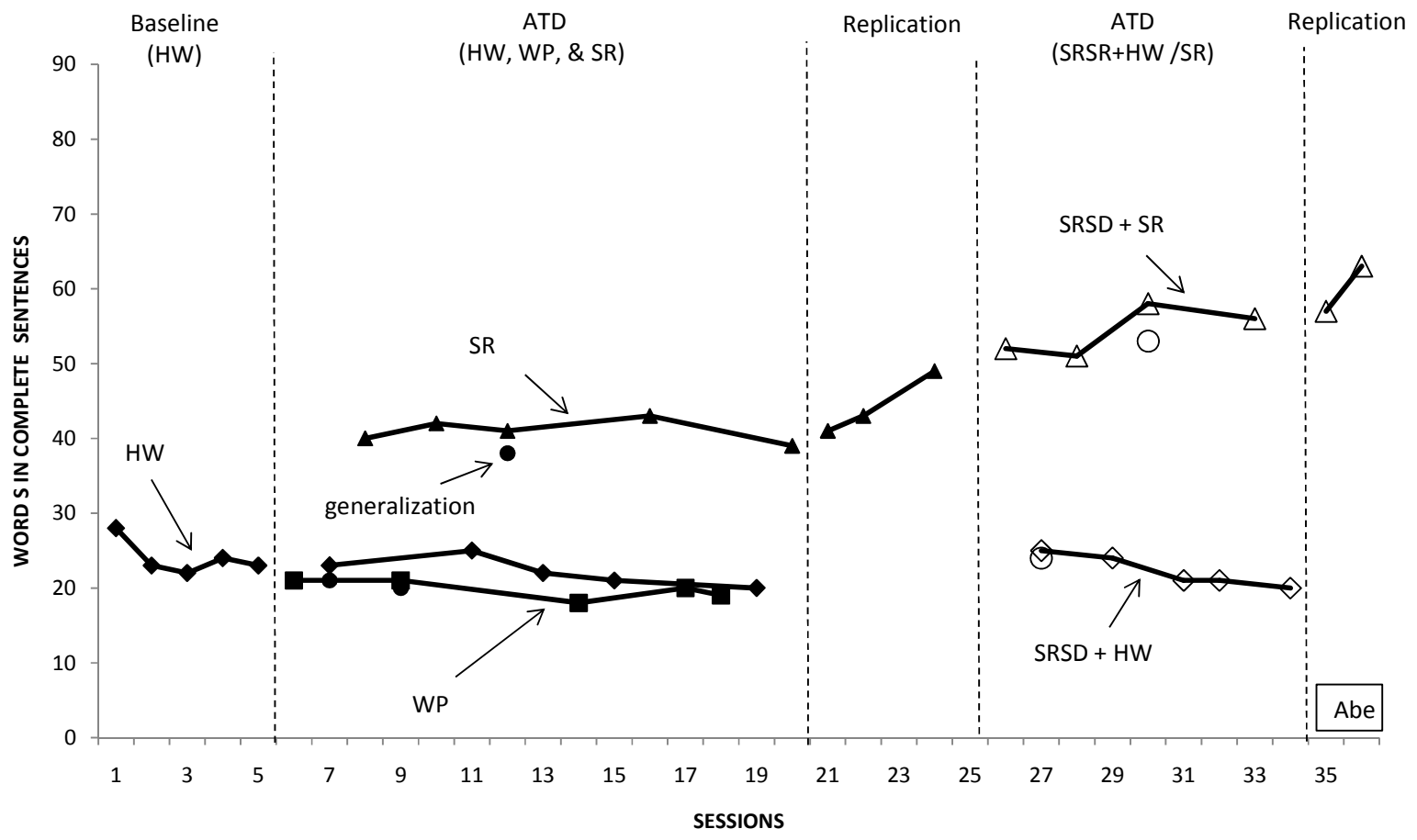


Figure 3 (panel 1). Words in complete sentences

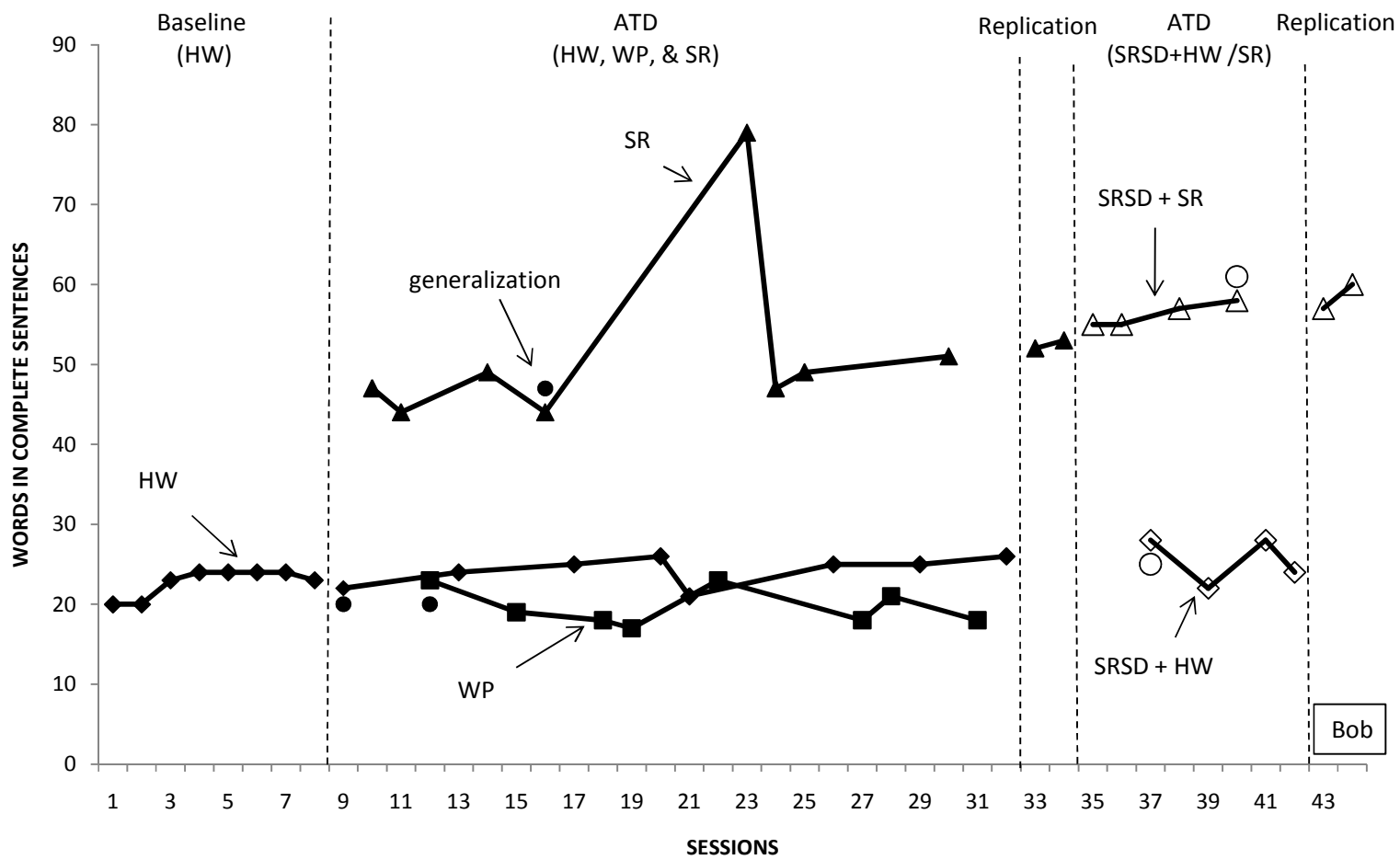


Figure 3 (panel 2). Words in complete sentences

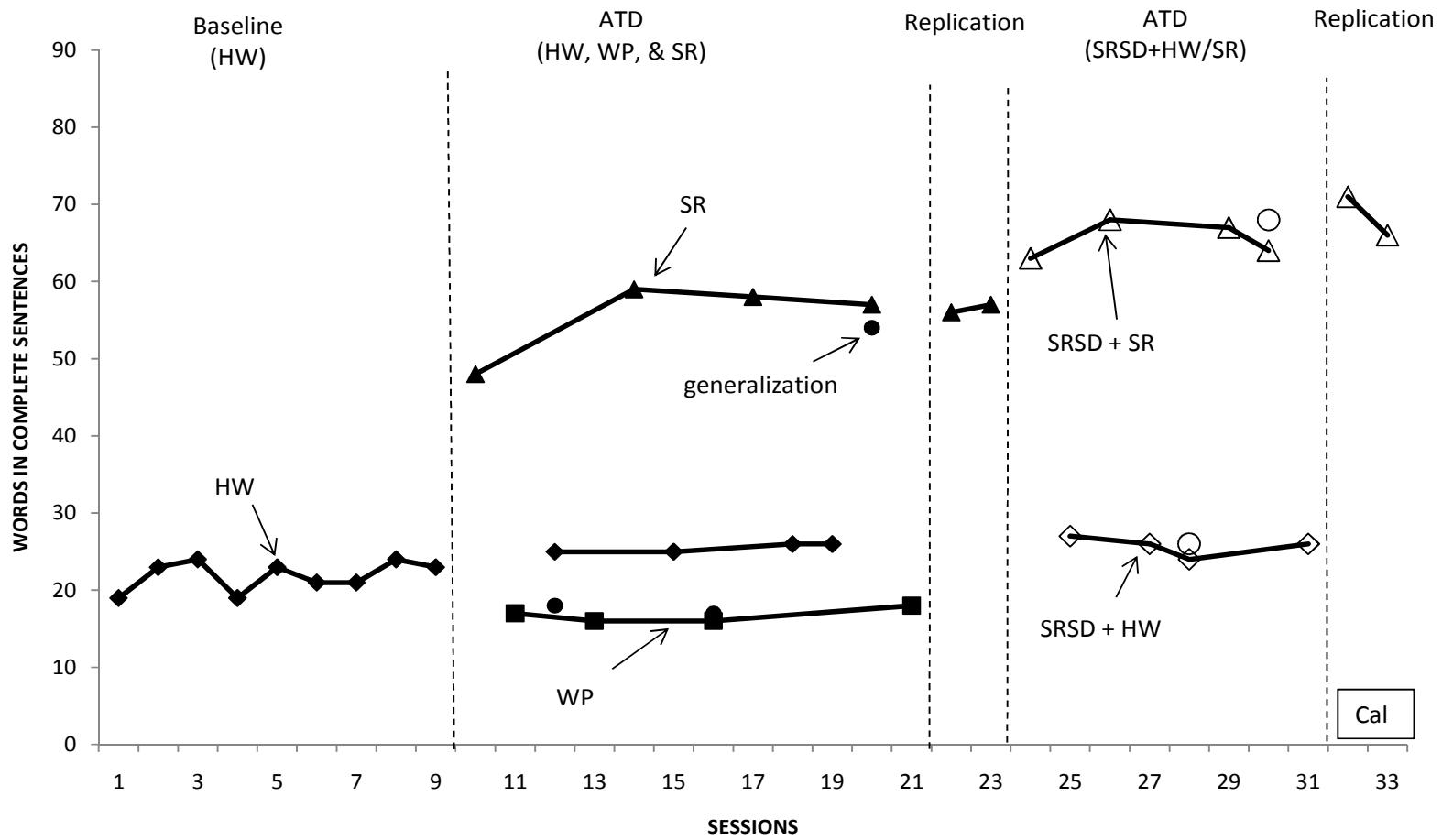


Figure 3 (panel 3). Words in complete sentences

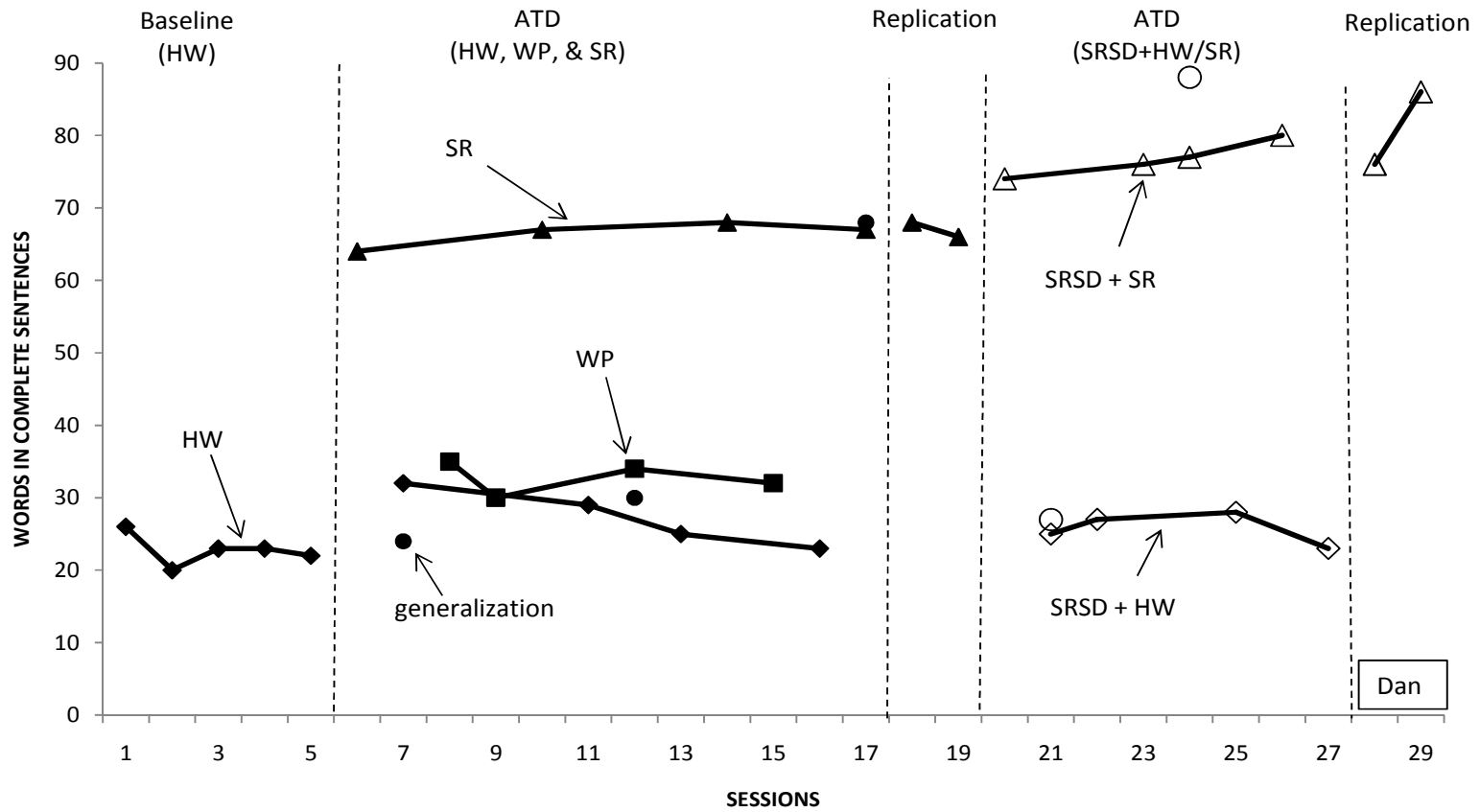


Figure 3 (panel 4). Words in complete sentences

The third dependent variable, %CWS, is a measure of writing accuracy that considers spelling and correct grammar usage (Shinn, 1989). Table 3 (p. 75) presents means and standard deviations data. Data did not achieve similar stability for all participants with respect to %CWS (see Figure 4, panels 1-4, pp. 76 - 79). Abe (Panel 1, p. 76) and Dan's (Panel 4, p. 79) obtained near perfect or perfect accuracy across baseline writing passages with Abe's ranging from 92 – 100 and Dan obtaining perfect scores every baseline session. However, Bob's (Panel 2, p. 77) and Cal's (Panel 3, p. 78) %CWS performances were variable, with ranges of 70 – 100 and 65 – 100, respectively. Thus, two of the participants (Abe and Dan) had very little difficulty with spelling and grammar usage, which is consistent with some of the previous research reported for children with AS (Myles et al., 2003). Bob and Cal, however, performed poorly in this area.

Table 3

Mean Percentage of Correct Word Sequences

| Participants | <u>Baseline</u> | | <u>HW</u> | | <u>WP</u> | | <u>SR</u> | | <u>Replication</u> | | <u>SRSD+HW</u> | | <u>SRSD+SR</u> | | <u>Replication</u> | |
|--------------|-----------------|-------------|-----------|-------------|-----------|-------------|-----------|---------------------|--------------------|-------------|----------------|-------------|----------------|-------------|--------------------|-------------|
| | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> |
| Abe | 98.40 | (3.58) | 98.40 | (3.58) | 100.00 | (0.00) | 100.00 | (0.00) | 100.00 | (0.00) | 100.00 | (0.00) | 100.00 | (0.00) | 100.00 | (0.00) |
| Bob | 83.75 | (10.38) | 83.50 | (11.76) | 82.00 | (11.39) | 92.43 | (3.82) ^c | 90.20 | (2.83) | 75.50 | (9.33) | 91.50 | (3.42) | 95.50 | (3.54) |
| Cal | 82.44 | (14.09) | 81.00 | (8.72) | 92.00 | (9.56) | 93.50 | (3.11) | 97.00 | (1.41) | 81.50 | (10.08) | 94.00 | (2.94) | 95.00 | (1.41) |
| Dan | 100.00 | (0.00) | 95.25 | (5.85) | 89.00 | (7.96) | 95.00 | (1.41) | 95.00 | (2.83) | 100.00 | (0.00) | 95.25 | (0.96) | 95.50 | (0.71) |

Note. ^c Mean and SD without outlier. With outlier $M = 92.38$, $SD = 3.54$

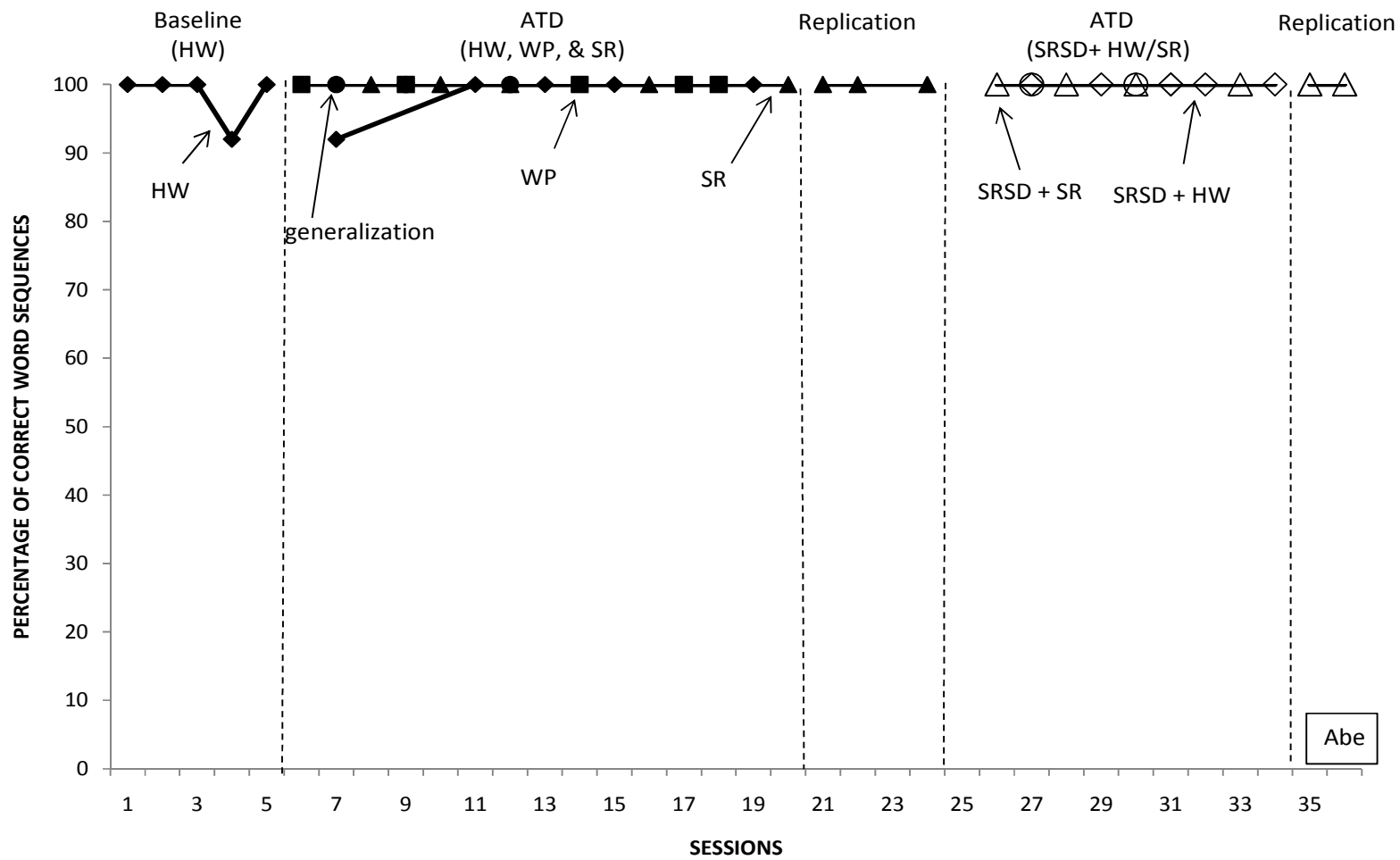


Figure 4 (panel 1). Percentage of correct word sequences

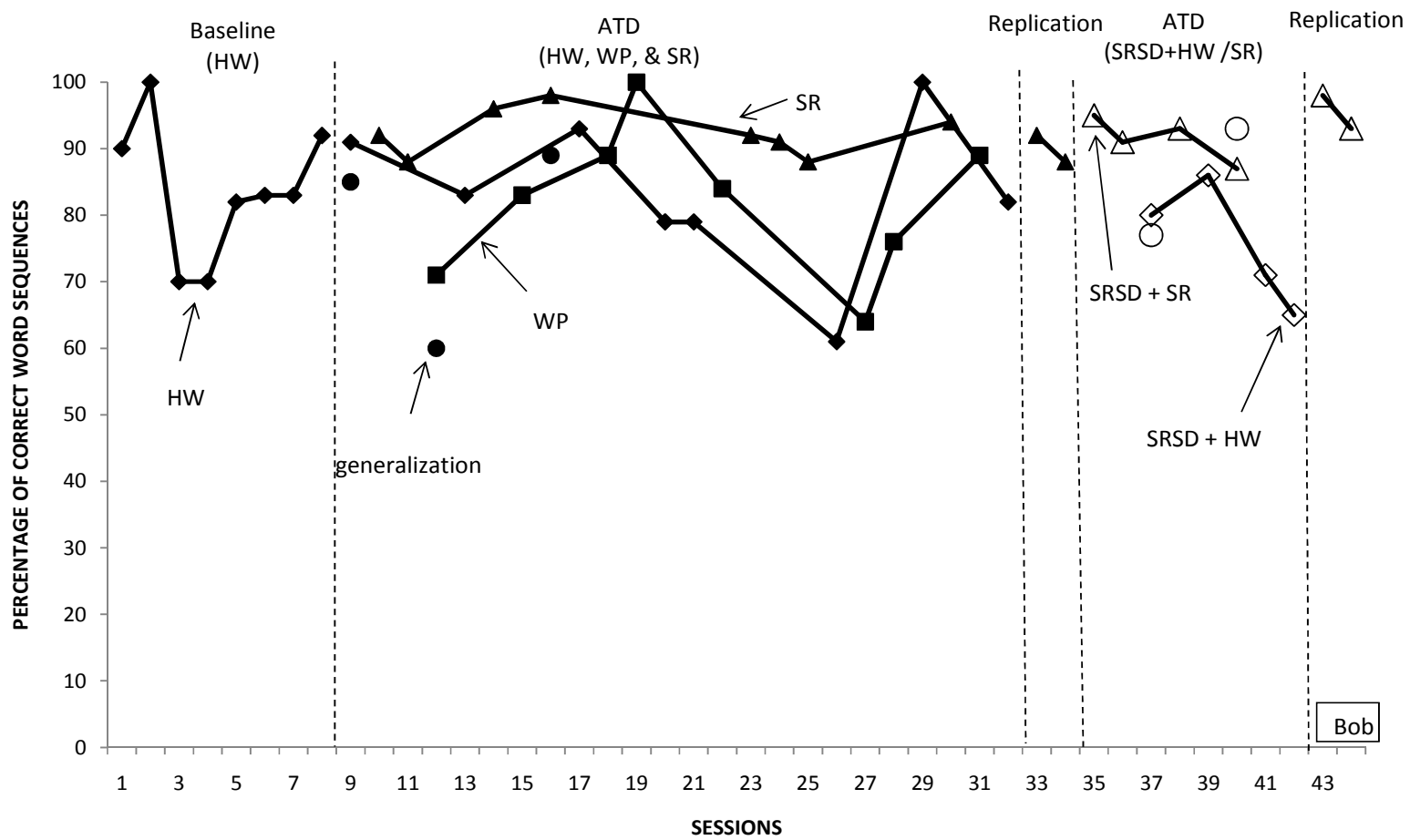


Figure 4 (panel 2). Percentage of correct word sequences

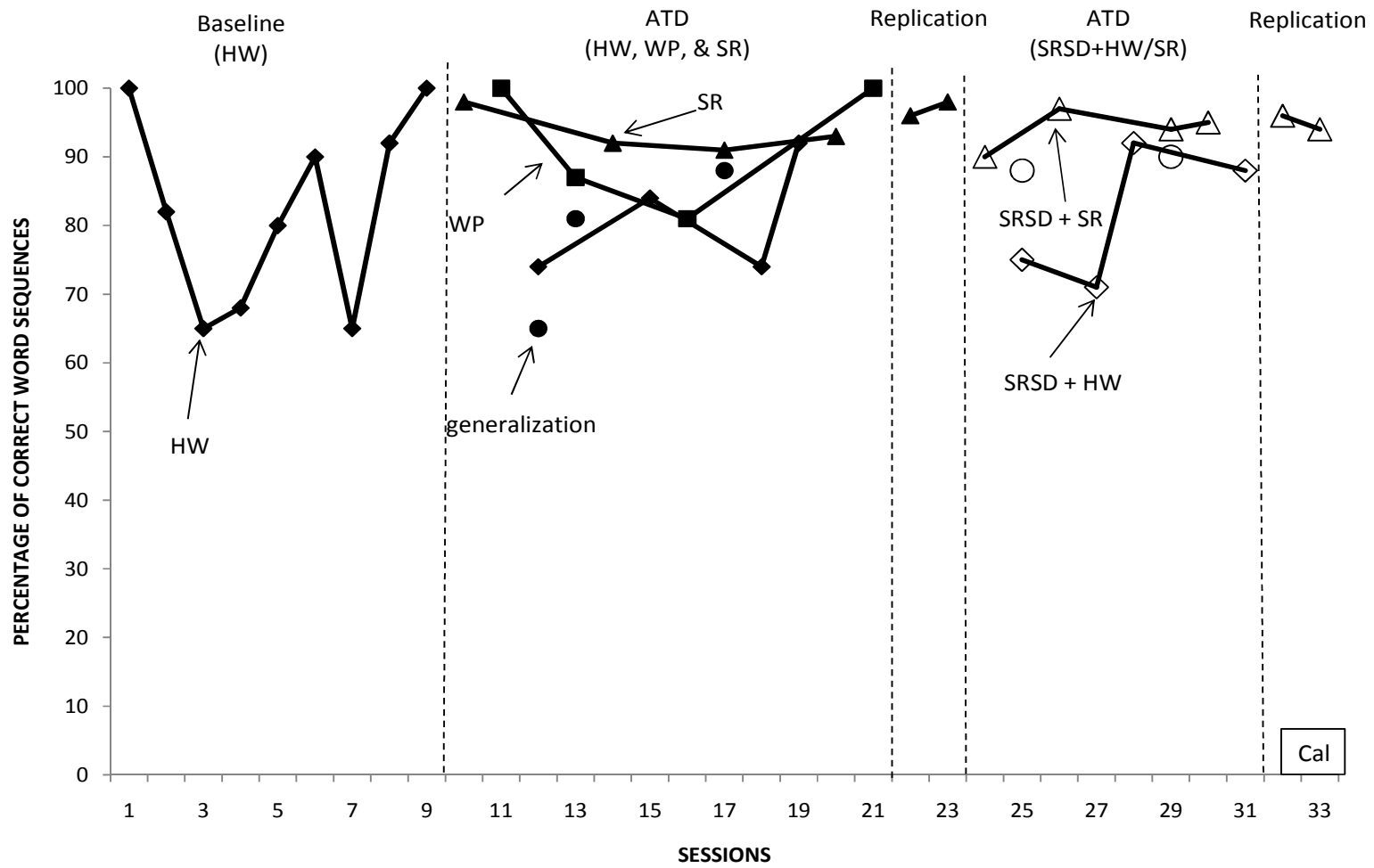


Figure 4 (panel 3). Percentage of correct word sequences

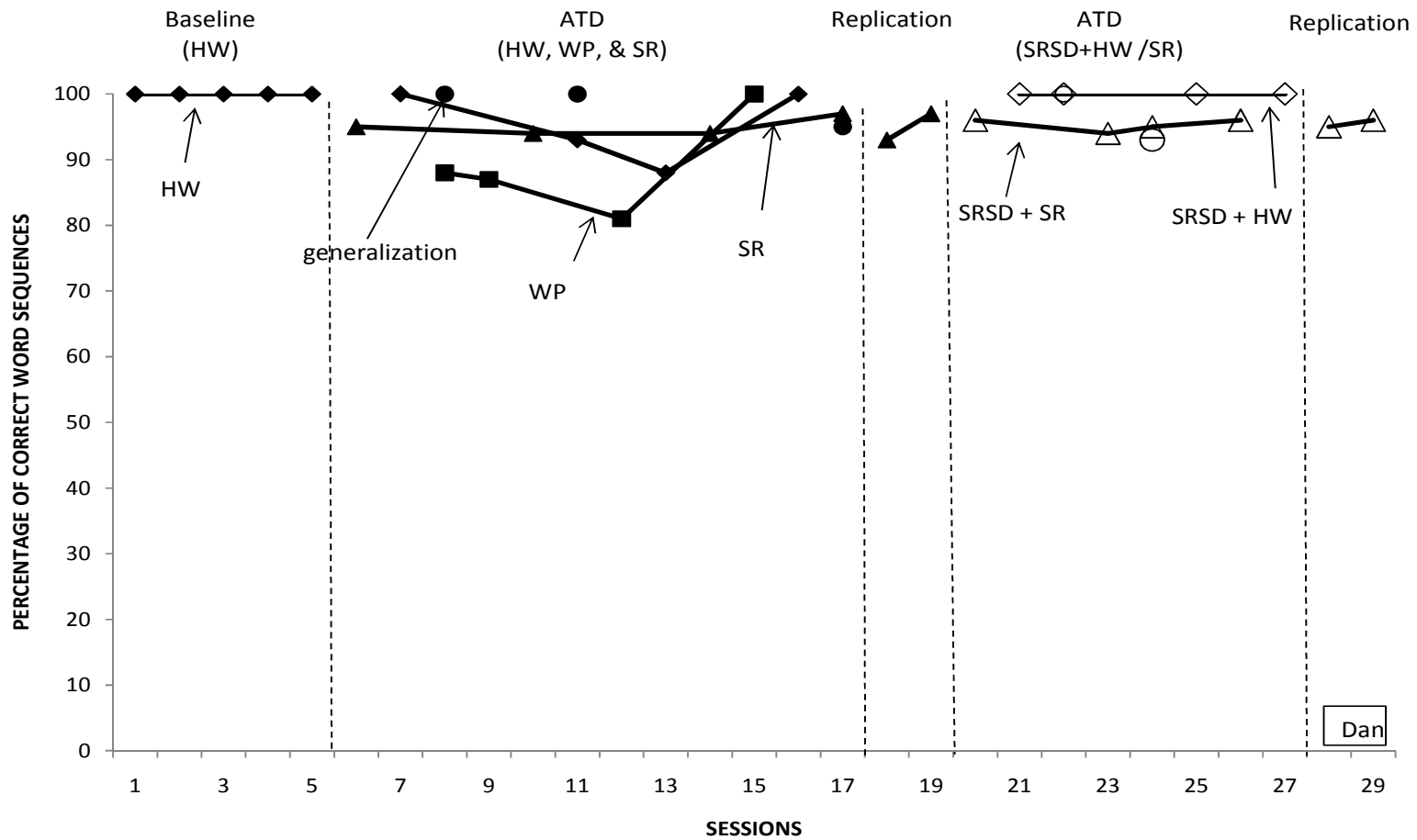


Figure 4 (panel 4). Percentage of correct word sequences

Studies examining the effectiveness of the SRSD intervention for students with AS frequently use number of story parts as a variable, as it is one of the important aspects of writing taught to students in this intervention package (Asaro, 2009; Asaro & Saddler, 2009; Delano, 2007; Lienemann et al., 2006; Reid & Lienemann, 2006). It is a measure of story completeness and overall story quality (Graham & Harris, 1989). As seen in Figure 5 (Panels 1 – 4, pp. 82 - 85) and Table 4 (p. 81), the number of story parts (0 – 7) within baseline scores were variable for all participants, with the majority obtaining ranges from 1 – 3 story parts, except for Dan, whose performance ranged from 2 - 3 story parts during baseline. No participant obtained higher than 3 story parts during the baseline phase; thus, all participants' stories were missing many critical elements (Asaro, 2008).

Table 4
Mean Number of Story Parts

| Participants | <u>Baseline</u> | | <u>HW</u> | | <u>WP</u> | | <u>SR</u> | | <u>Replication</u> | | <u>SRSD+HW</u> | | <u>SRSD+SR</u> | | <u>Replication</u> | |
|--------------|-----------------|-------------|-----------|-------------|-----------|-------------|-----------|---------------------|--------------------|-------------|----------------|-------------|----------------|-------------|--------------------|-------------|
| | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> |
| Abe | 1.60 | (0.89) | 1.80 | (0.45) | 1.80 | (0.84) | 3.60 | (0.89) | 3.33 | (0.58) | 3.80 | (0.84) | 6.25 | (0.50) | 6.50 | (0.71) |
| Bob | 2.25 | (0.89) | 2.00 | (0.54) | 1.75 | (0.71) | 3.43 | (0.53) ^d | 3.50 | (0.71) | 4.00 | (0.00) | 5.50 | (0.58) | 5.00 | (0.00) |
| Cal | 2.12 | (0.60) | 2.25 | (0.50) | 2.00 | (0.00) | 4.00 | (0.00) | 4.00 | (0.00) | 3.75 | (0.50) | 5.00 | (0.00) | 5.00 | (0.00) |
| Dan | 2.40 | (0.55) | 2.75 | (0.50) | 3.00 | (0.00) | 3.75 | (0.50) | 4.50 | (0.71) | 3.25 | (0.50) | 6.50 | (0.58) | 6.00 | (0.00) |

Note. ^d Mean and SD without outlier. With outlier *M* = 3.50, *SD* = 0.54

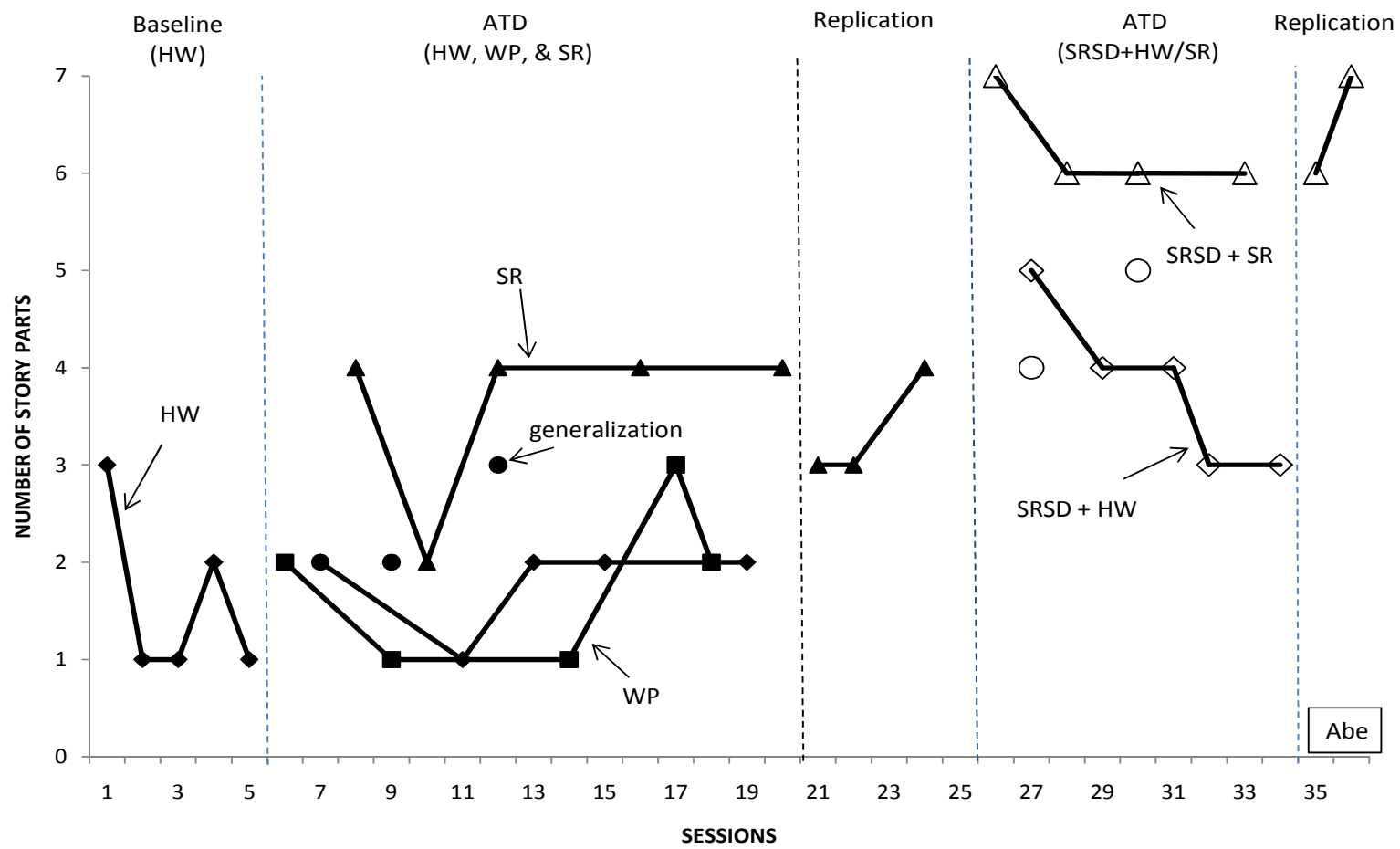


Figure 5 (panel 1). Number of story parts

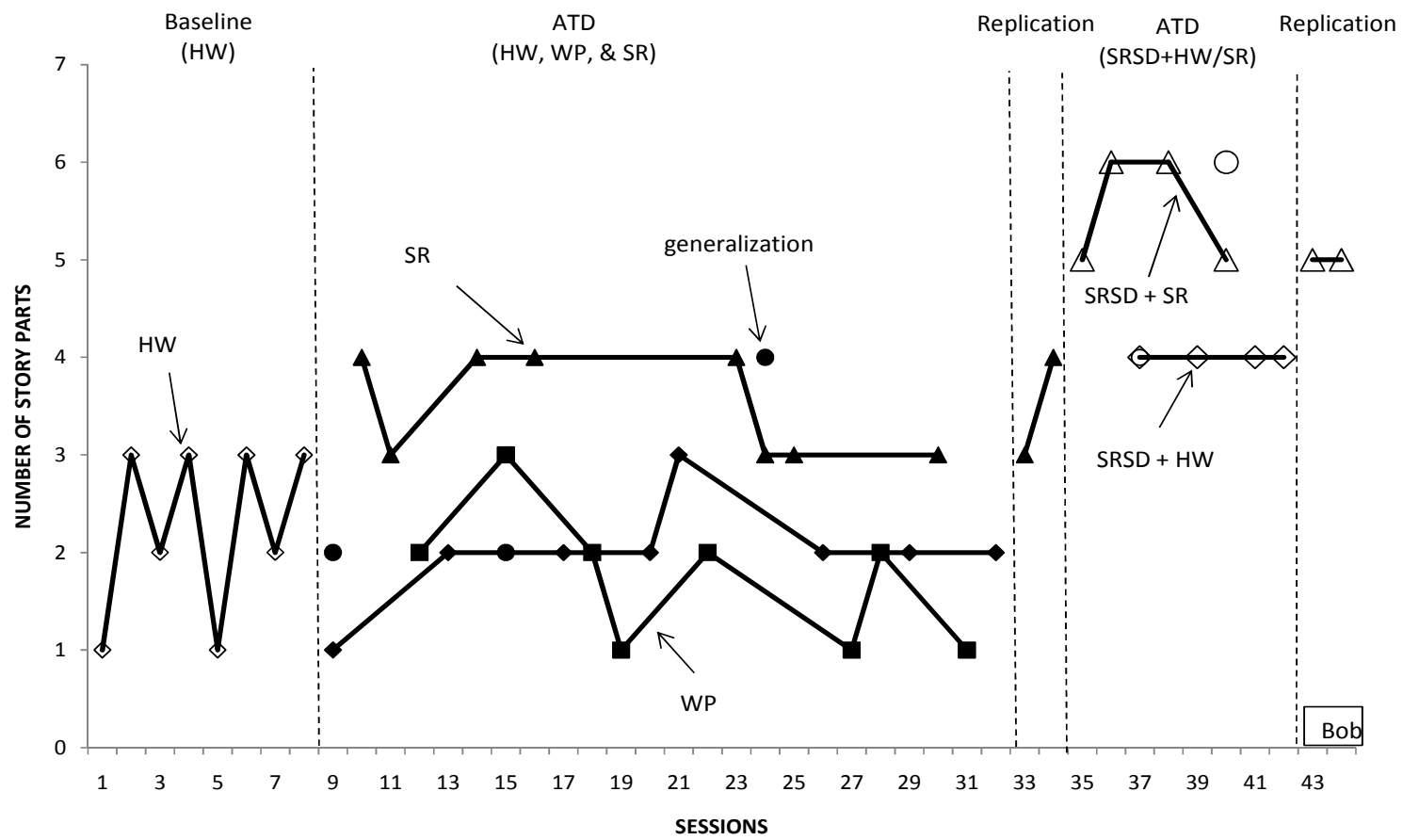


Figure 5 (panel 2). Number of story parts

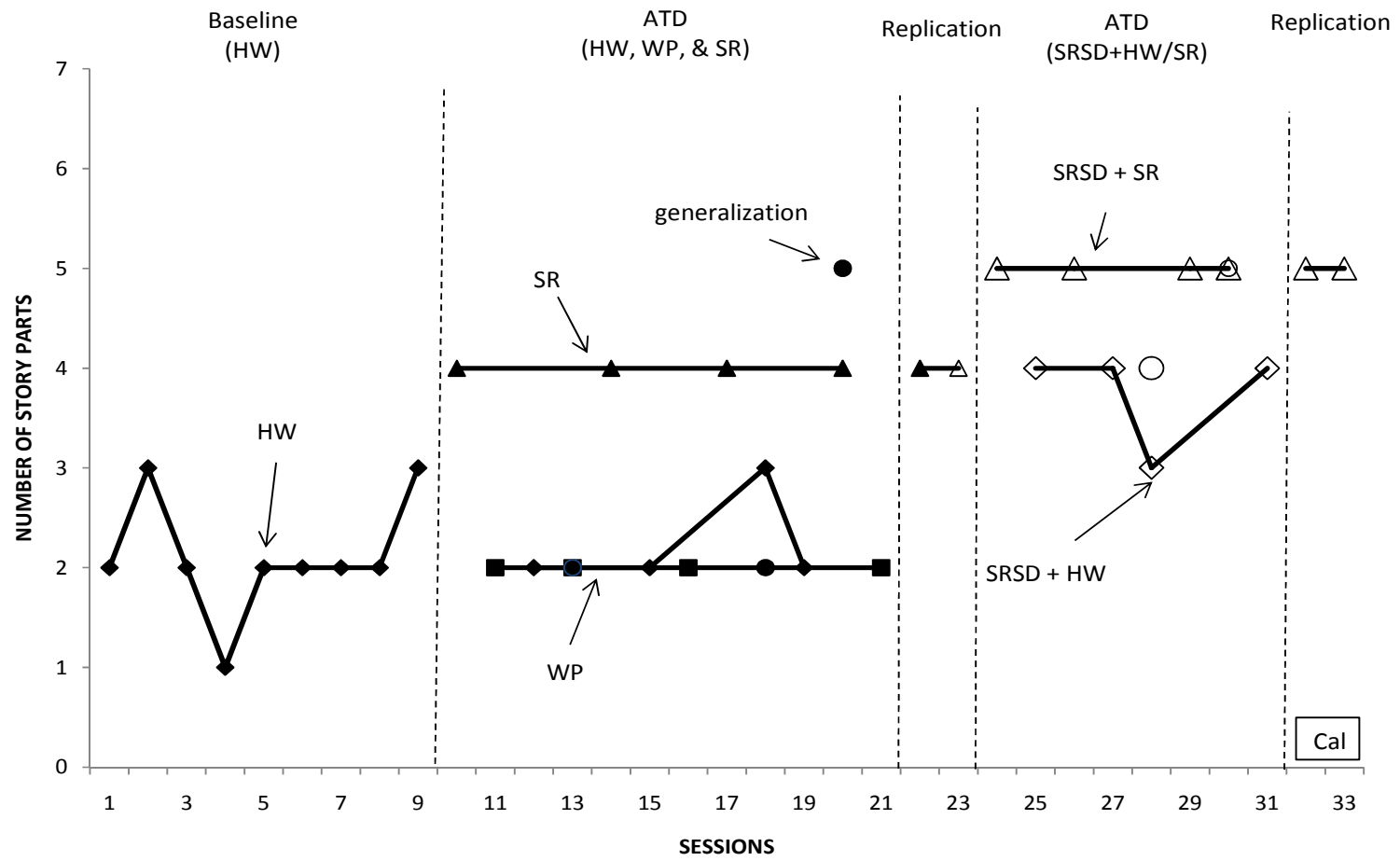


Figure 5 (panel 3). Number of story parts

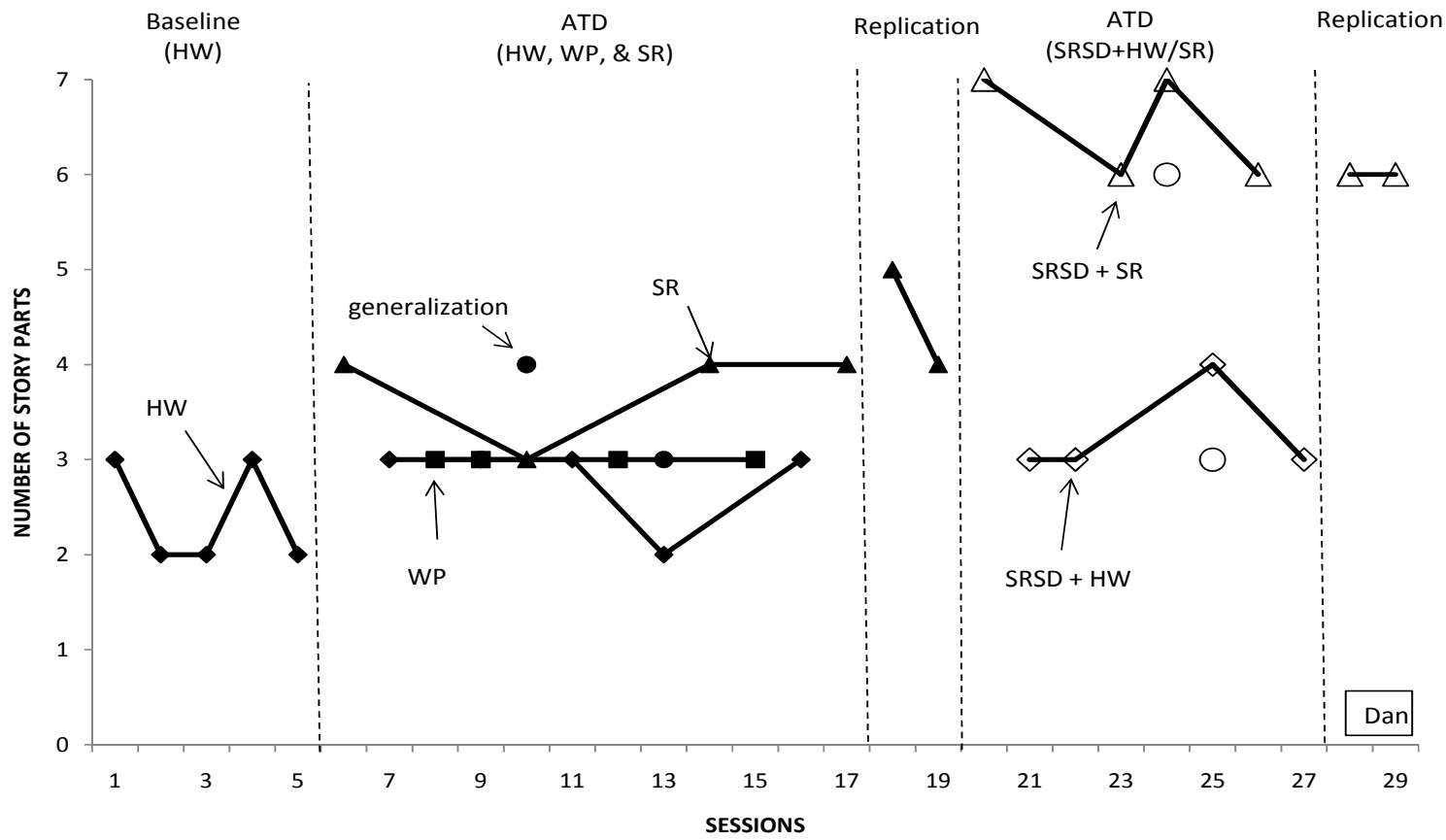


Figure 5 (panel 4). Number of story parts

Alternating Treatments (HW, WP, and SR)

HW. In the HW condition, TWW data were stable across participants and the flat trends were maintained consistent with the baseline phase (see Figure 2, panels 1-4, pp. 64 - 67). There was no level change across phases.

TWW and WCS data in the first ATD were consistent with baseline responding, without a change in level and continued flat trends. It should be noted that all participants' WCS and TWW scores were identical across the baseline phase to the alternating treatment phase, suggesting that these participants did not have any difficulty with basic sentence structure (e.g., subject and a verb), capitalization of initial words in a sentence, and ending punctuation (See Figure 3, panels 1 – 4, pp. 70 - 73).

%CWS data were relatively stable for Abe and Dan, with ranges of 92 – 100 and 88 – 100, respectively. However, Bob and Cal's data were more variable, with ranges of 61 – 100 and 74 – 92, respectively (See Figure 4, panels 1 – 4, pp. 76 - 79). Both outcomes were consistent with their respective baseline performances and levels were maintained across this phase.

Across participants, there was no level change in number of story parts from baseline, trends were flat, and there was similar variability from baseline, with Abe's range of 1 – 2, Bob's range of 1 – 3, Cal's range from 2 – 3, and Dan's range from 2 – 3. In keeping with baseline, no participant obtained more than 3 story parts in this condition.

WP. When using the WP accommodation, all participants except Dan typed fewer average TWW than during the baseline and HW conditions (see Table 1, p. 63). There were no level changes compared to baseline performance for Abe and Bob. However, Cal showed a lower level of responding to the WP accommodation when compared with

baseline, and Dan displayed higher performance (See Figure 2, panels 1 – 4, pp. 64 - 67). As presented in Figure 2, Abe's (Panel 1, p. 64), Bob's (Panel 2, p. 65), and Cal's (Panel 3, p. 66) TWW data were stable and revealed flat trends. There was differentiation with no overlapping data points between the HW and WP conditions for Cal, with handwriting resulting in more TWW. There was also differentiation between HW and WP conditions for Dan (Figure 2, panel 4, p. 67) with better performance observed under the WP condition. Taken together these data suggest that except for Dan, the WP accommodation did not result in better writing production than HW. As was the case in the HW condition, TWW and WCS data were also identical in the WP condition.

For %CWS, which assesses the structural components of writing (e.g., spelling, punctuation within sentences, and capitalization), the only participant who had a change in level across phases was Dan, favoring the baseline condition. There was little differentiation between Abe's HW and WP scores, with the exception of one HW data point below 100, suggesting that Abe's use of the WP accommodation had very little impact on spelling and grammar usage (Figure 4, panel 1, p. 76). Bob's performance revealed similar results, although HW and WP scores were more variable and had no discernable trend (Figure 4, panel 2, p. 77). Cal and Dan yielded opposite results (see Table 3, p. 75), although performance for both were variable, with Cal's performance favoring the use of WP over HW and Dan's performance benefiting more from HW than WP (Figure 4, third and fourth panels, respectively, pp. 78 - 79). Dan was the only participant for whom using WP decreased writing accuracy (Figure 4, panel 4, p. 79).

As shown in Figure 5 (Panels 1 – 4, pp. 82 - 85), levels of responding for number of story parts were consistent from baseline to the ATD across participants. There were

very little differences among the participants in terms of number of story parts when handwriting their stories compared to using the WP accommodation. In the WP condition, there was no discernable increasing or decreasing trends for any participant and rates of performance were consistent with the baseline condition.

SR. There was a significant level change from baseline across all participants, favoring the SR accommodation from baseline to the alternating treatment phase. Across all participants, the use of SR resulted in higher TWW scores when compared to both HW and WP, without any overlap between the SR intervention and WP or HW data points. Figure 2 (Panels 1 – 4, pp. 64 - 67) reveals a clear differentiation between SR and both WP/HW interventions, suggesting that the use of SR is a relatively more successful accommodation to increase story length. As seen in Table 1 (p. 63), Dan had the highest mean (range 64 - 67), followed by Cal (range 48 - 59), Bob (range 44 - 51), and then Abe (range 39 - 43). It should be noted that Bob had one outlier during this phase (79 TWW) and this was subsequently removed from his ultimate mean calculation. It is hypothesized that Bob may have produced a longer story because it was a topic that encompassed his special interest area (i.e., war battles). As seen in baseline, HW, and WP conditions, TWW and WCS mean scores did not differ across participants when using SR.

In terms of %CWS, Figure 4 (panel 1, p. 76) shows that Abe did not demonstrate a level change from baseline. However, when compared to baseline responding, Bob and Cal performed better with the SR accommodation but, for Dan, the opposite was true. Figure 4 (Panel 1, p. 76) reveals that Abe's SR scores did not differ from his HW and WP scores and he continued to score consistently high across all interventions with very little fluctuation in scores. This is likely because Abe already was performing at near perfect

levels of accuracy during baseline. Like Abe, Dan showed very little differentiation between HW and SR interventions, revealing that the use of SR had very little impact on this variable. It should be noted that neither participant demonstrated struggles with the structural components of handwriting stories when compared to Bob and Cal, whose baseline scores were lower. For Bob, there was differentiation between SR and both HW and WP conditions. There was no overlap between HW and SR performance and only one overlapping data point between WP and SR. These data suggest that the use of the SR intervention assisted with some of the structural components of writing with which Bob struggled the most (e.g., spelling). Cal also obtained a relatively better performance when using the SR accommodation compared to HW. Differentiation favored SR relative to HW but not WP (Figure 4, panel 3, p. 78), illustrating only one overlapping data point. There was no differentiation between Dan's performance using the SR accommodation as compared to the WP accommodation. Thus, both WP and SR improved some of the spelling and grammatical errors observed in Dan's handwritten work.

Figure 5 (Panels 1 – 3, pp. 82 – 84) illustrates the number of story parts written. There was a definitive level increase for all participants when the SR condition is compared to baseline responding. For Abe, Bob, and Cal, the SR was differentiated from both HW and WP with no overlapping data points. A similar pattern was observed for Dan (Figure 5, panel 4, p. 85) although one overlapping data point occurred. These data suggest that the SR accommodation resulted in increases in the number of story parts produced by all participants and was better than both the HW and the WP conditions.

In sum, during the first ATD condition, baseline was compared with WP and SR accommodations. Across most dependent variables (TWW, WCS, and number of story

parts), there was differentiation for SR as compared to HW and WP. There was no differentiation between handwriting and WP for 3 of the 4 participant across any dependent variables. Cal was the only participant in which HW was differentiated from WP, favoring HW. Compared to baseline, SR produced significant level changes that resulted in higher albeit stable performance.

Replication

Given that SR resulted in the highest TWW per three minute writing sample across all participants and was clearly differentiated from both HW and WP (See Figure 2, panels 1 – 4, pp. 64 - 67), it was administered in isolation in the replication phase. The replication phase serves to strengthen the case for demonstrating a functional relationship between an intervention and the target behavior. Abe, Bob, and Cal continued to obtain TWW and WCS mean scores at the same level as seen in the first ATD condition but with slightly increasing trends (See Figures 2 and 3, panels 1 – 4, pp. 64 – 67, pp. 70 - 73). Dan also obtained scores at the same level but with a slightly decreasing trend.

In terms of %CWS, Abe maintained his perfect accuracy seen during the first ATD condition, Cal and Dan revealed the same level with slightly increasing trends, and Bob showed the same level of responding but with a slightly decreasing trend (See Figure 4, panels 1 – 4, pp. 76 - 79).

Figure 4 (Panel 3, p. 78) revealed that Cal maintained the equivalent level of responding in terms of number of story parts, Abe and Bob (See Figure 5, panels 1 and 2, pp. 82 - 83) also maintained their mean levels but with slightly increasing trends, and Dan showed a slight increase in level but with a decreasing trend (See Figure 5, panel 4, p. 85).

Alternating Treatments (SRSD + handwriting and SRSD +SR)

SRSD + handwriting. Across all participants, the addition of the SRSD intervention to the handwriting baseline condition did not improve TWW from baseline and the first ATD phase, as there were no level changes observed across participants (See Figure 2, panels 1 – 4, pp. 64 - 67). In addition, there were no discernable changes in trend, with the exception of Abe, who showed a slight decreasing trend when SRSD was added to HW. As in all other phases, WCS continued to be identical to TWW during this phase as well.

With regard to %CWS (See Figure 4, panel 1, p. 76), the addition of the SRSD to HW had no impact on Abe's performance as he continued to maintain a perfect score of 100 throughout the remaining phases. Dan also maintained a perfect score in this condition, which was a slight increase in level from the first ATD phase (See Figure 4, panel 4, p. 79). Data from Bob and Cal, the two participants who evidenced more difficulties in this domain, revealed that the addition of SRSD to HW did not improve mean %CWS scores (See Table 3, p. 75).

Figure 5 (Panels 1 - 3, pp. 82 - 84) reveals that the addition of the SRSD intervention to the HW condition had the most positive impact on number of story parts, as there were level changes observed across three of the four participants (Abe, Bob, and Cal). Dan did not evidence a change in level of responding, but did show a slightly higher number of story parts in this phase (range 3 – 4) than in the initial ATD (range 2 – 3; See Figure 5, panel 4, p. 85).

SRSD + SR. The combination of the SRSD intervention with the SR accommodation resulted in level changes for TWW when compared to SR alone across participants and compared to baseline (See Figure 2, panels 1 – 4, pp. 64 - 67). In addition,

differentiation favored the SR+SRSD over the HW+SRSD condition. As in other phases, the WCS data continued to be identical to TWW data.

In terms of %CWS, the addition of the SRSD intervention to the SR accommodation made very little difference in terms of level of responding across participants when compared to the initial ATD phase (See Figure 4, panels 1 – 4, pp. 76 - 79). However, for the two participants (Bob and Cal) who had the most difficulties in this domain, these conditions continued to be differentiated, favoring SRSD + SR (See Figure 4, second and third panels, respectively, pp. 77 - 78). The addition of the SRSD intervention to the SR accommodation had the opposite effect on Dan, who showed differentiation between the two conditions in favor of SRSD + HW (See Figure 4, panel 4, p. 79). It should be noted that Dan often exclaimed that he did not want to “stop and make his work perfect” while he was quickly speaking his stories aloud into the computer.

For the number of story parts, all participants showed a change in level of responding when the SRSD intervention was combined with the SR accommodation when compared to baseline and the initial ATD phase (See Figure 5, panels 1 – 4, pp. 82 - 85). A level change was also observed when SRSD was added to HW; however, consistent with TWW and WCS, there was differentiation between interventions, favoring SRSD + SR across all students. It is evident that the addition of the SRSD intervention had the greatest impact on number of story parts in both conditions, but demonstrated the most successful results when paired with the SR accommodation.

In sum, during the second ATD phase, the SRSD intervention was combined with HW and SR, respectively. When the SRSD + SR condition was introduced, this condition produced a positive level change in TWW, WCS, and number of story parts when

compared to baseline and the initial ATD phase. The combination of SRSD + HW only improved the number of story parts when compared to baseline, HW, and WP, but not more than the SR accommodation alone. There was differentiation between the SRSD + SR and the SRSD + HW conditions, with greater performance yielded under the SRSD + SR condition. Results with %CWS were variable, as the addition of SRSD had no impact on three of the four participants and decreased performance slightly for one student (Dan).

Replication

Because SRSD + SR resulted in the higher TWW and was differentiated from the SRSD + HW condition, it was replicated for two additional sessions for each participant. As seen in Table 1 (p. 63), all participants maintained similar levels across phases with Abe, Bob, and Dan revealing slightly increasing trends and Cal with a slightly decreasing trend. As in all other phases, WCS and TWW data were identical.

%CWS data were also maintained at their respective levels with Abe maintaining his mean of 100, Dan showing a slight increase in trend, and Bob and Cal showing slight decreases in trend (See Table 3, p. 75)

Number of story parts (See Figure 5, panels 1 – 4, pp. 82 - 85) were also maintained at the levels attained during the second ATD, with Bob (Panel 2, p. 83), Cal (Panel 3, p. 84), and Dan (Panel 4, p. 85) remaining stable across their two data points and Abe (Panel 1, p. 82) showing a slight increase in trend.

Generalization

Figures 2 (panels 1 – 4, pp. 64 – 67), 3 (panels 1 – 4, pp. 70 – 73), 4 (panels 1 – 4, pp 76 – 79), and 4 (panels 1 – 4, pp. 82 – 85) also present generalization data in all panels. For TWW and WCS, all participants displayed comparable results with their respective

interventions, indicating that skills were generalized with respect to story length when assessing participants' creative story homework assignments. The same was true with respect to %CWS and the number of story parts, indicating that skills were generalized with all accommodations and interventions across variables and participants.

Social Validity

Treatment acceptability was assessed for the participants as well as their parents. The participants completed the CIRP to assess the degree to which the participants believed that the various interventions were appropriate, reasonable, fair, and useful. The CIRP contains 7 questions on a likert scale, ranging from 1 (*disagree*) to 6 (*agree*), with higher scores representing a more acceptable intervention. Table 5 contains the qualitative statistics of all interventions for each participant, including the baseline handwriting condition.

Overall, it is apparent from the results of the CIRP that participants preferred the SRSD + SR intervention the most and the baseline HW condition the least (See Table 5, p. 95). When comparing the individual accommodations in the first ATD (WP and SR), three of the four participants had a slight preference for SR over WP and one yielded opposite results. In sum, both accommodations were highly preferred over HW but both were similarly liked. In the second ATD, there was a preference of SRSD + SR over SRSD + HW across all participants.

Table 5

Mean acceptability scores on the CIRP

| Participants | <u>HW</u> | | <u>WP</u> | | <u>SR</u> | | <u>SRSD+HW</u> | | <u>SRSD+SR</u> | |
|--------------|-----------|-------------|-----------|-------------|-----------|-------------|----------------|-------------|----------------|-------------|
| | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> |
| Abe | 3.29 | (2.29) | 4.29 | (1.89) | 4.14 | (2.41) | 4.29 | (2.21) | 4.43 | (2.07) |
| Bob | 3.14 | (2.67) | 4.29 | (1.98) | 4.57 | (2.44) | 4.14 | (2.41) | 5.57 | (1.13) |
| Cal | 3.14 | (2.67) | 4.00 | (1.53) | 4.14 | (2.27) | 4.00 | (1.73) | 4.29 | (2.21) |
| Dan | 2.71 | (2.36) | 4.00 | (2.08) | 4.29 | (2.36) | 3.71 | (2.29) | 4.43 | (2.07) |
| Total | 21.50 | (1.73) | 29.00 | (1.15) | 29.75 | (1.50) | 28.25 | (2.92) | 32.75 | (4.19) |

Parents were given the IRP-15 to assess their preferences among the interventions. This scale contains 15 statements regarding the acceptability of each individual treatment. Like the CIRP, the IRP-15 is based on a likert scale, ranging from 1 (*strongly disagree*) to 6 (*strongly agree*), with higher scores representing a more preferable intervention. These findings are displayed in Table 6 (p. 96). As found with their children, parents also strongly preferred the SRSD + SR intervention over the HW baseline condition. In the second ATD condition, parents also preferred the SRSD + SR over the SRSD + HW condition.

Table 6

Mean acceptability scores on the IRP-15

| Participants | <u>HW</u> | | <u>WP</u> | | <u>SR</u> | | <u>SRSD+HW</u> | | <u>SRSD+SR</u> | |
|--------------|-----------|-------------|-----------|-------------|-----------|-------------|----------------|-------------|----------------|-------------|
| | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> |
| Abe | 1.00 | (0.00) | 2.73 | (0.59) | 4.00 | (0.00) | 4.87 | (0.52) | 5.20 | (1.57) |
| Bob | 1.00 | (0.00) | 5.13 | (0.99) | 5.73 | (0.46) | 5.40 | (0.91) | 5.40 | (1.45) |
| Cal | 1.14 | (1.30) | 2.53 | (0.52) | 5.40 | (1.06) | 5.00 | (0.00) | 5.33 | (1.76) |
| Dan | 1.53 | (0.52) | 4.80 | (0.56) | 5.47 | (1.19) | 5.13 | (0.83) | 5.53 | (1.13) |
| Total | 18.75 | (4.35) | 57.00 | (20.35) | 77.25 | (11.70) | 76.50 | (3.42) | 80.50 | (2.08) |

Chapter V

Discussion

This chapter provides a summary and discussion of the results. Included is a discussion of the limitations of the present study as well as suggestions for future research.

The purpose of this dissertation was to investigate three issues. First, I compared two individual writing accommodations (WP and SR) with HW in order to determine which would result in better written language fluency and production for students with AS. Variables measured included TWW and WCS, which focus on writing production and fluency, %CWS, which assesses writing accuracy, and number of story parts, a measure of story completeness and overall quality. Second, I examined whether the addition of the SRSD writing intervention to the SR accommodation would have an additive effect on improvements in written language fluency, accuracy, and overall story quality. Last, I determined whether written language improvements made with the accommodations alone and combined with SRSD would be generalized to homework writing assignments.

Effectiveness of Accommodations

Writing fluency. As far as I am aware, this study is the only one that compares HW, WP, and SR for struggling writers. It also appears to be the first study to examine the usefulness of the SR accommodation for students with AS who also struggle with writing. I decided to first examine the relative effectiveness of two writing accommodations in order to examine the effectiveness of WP, a frequently utilized accommodation for students with AS (Myles et al., 2003). This study hypothesized that while the use of the SR accommodation would result in more fluent written work, it would likely be insufficient to address deficiencies in story quality and content generation (Quinlan, 2004). This led to

the development of the second hypothesis, discussed in the following section, which suggests that the most comprehensive writing improvements would result from combining a writing accommodation and a specific writing intervention (Berninger et al., 2008; Hollenbeck et al., 1999; MacArthur & Graham, 1987).

Current study results supported the hypothesis that the SR accommodation would enable participants to produce more fluently written work (evaluated via TWW and WCS) as SR data differentiated positively from both HW and WP data across all participants. Thus, participants “wrote” longer stories when provided the SR accommodation. SR was also the accommodation that parents and participants preferred over both HW and WP.

The fact that TWW and WCS data were identical across participants indicated the unique writing challenges of these students (Fein & Dunn, 2007; Myles et al., 2003). Although both TWW and WCS are measures of writing fluency, WCS differs from TWW, a general measure of writing production, in that there is a focus on the accurate production of complete sentences (Gansle, 2006). Thus, these participants’ identical performance on these variables may indicate that these participants all had a good understanding of the basic structure of a sentence (e.g., capitalization of initial word, use of a subject and verb, and appropriate end punctuation). It should be noted, however, that both measures included words that were spelled incorrectly, a skill best measured by the %CWS variable.

Writing accuracy. Since the extant literature suggested that students with AS do not tend to struggle with spelling and grammar (Griswold et al., 2002; Myles et al., 2003), I did not predict that there would be any differences across accommodations regarding these specific writing components, assessed by %CWS. It was clear from the findings, however, that these students had idiosyncratic writing skills. For two of the participants, Abe and

Dan, spelling and grammar usage was near perfect and the use of either accommodation did not change these results. Although Dan actually demonstrated less accurate work when using the SR accommodation, which was likely due to his reluctance to correct voice recognition errors as he was narrating his stories. The other two participants (Bob and Cal) struggled with grammar and spelling and consequently had differentially higher %CWS scores when using the SR accommodation compared to the HW and WP accommodations. This was likely due to the fact that the SR software automatically spells the words narrated into the computer correctly and often provides appropriate punctuation without the participant instructing it to do so, although, the participants had to sometimes clarify grammatical or spelling errors when the SR software did not accurately record their speech.

These improvements in writing accuracy support Quinlan's (2004) findings, the only study that examined writing accuracy and SR, that less fluent writers produced fewer spelling errors when using SR. She added that the gains made in fluency were likely due to reducing transcription interference and allowing students' working memory to be utilized for more accurate and fluent text production. In this current study, participants seemed less concerned about spelling during the SR condition (e.g., they did not ask the experimenter about whether words were spelled correctly as often using SR as they did in the WP and HW conditions) and did not appear to get as "stuck" while writing. Thus, participants may have been able to think less about accuracy in the SR condition, something De La Paz (1999) had also suggested. However, Quinlan noted the use of SR is not an intervention that teaches students how to write more accurately, thus it may not address all aspects of writing difficulties.

Writing quality. Another unforeseen outcome was that the use of the SR accommodation alone resulted in higher mean number of story parts when compared to HW and the WP accommodation, as it was differentiated from both conditions. Of the two previous studies that examined the effect of the SR accommodation on written language ability, one found improved essay quality, although better improvements were seen with a scribe (MacArthur & Cavalier, 2004). The other study only showed improvements in writing quality when SR was paired with SRSD, not when it was used alone (Quinlan, 2004). When the physical demands of writing are fully alleviated, as seen with the use of SR, the participants may have been able to draw upon more of their cognitive resources, allowing them to not only pay less attention to accuracy but to give more attention to generating meaningful content (De La Paz, 1999). It also may be that participants were able to write lengthier stories using the SR accommodation since their fine-motor skills were not being tapped, thus, providing an opportunity to increase the amount written and the subsequent number of story parts in their writing samples (De La Paz, 1999).

WP accommodation strengths and limitations. Interestingly, the use of the WP accommodation, which is commonly recommended for students with AS (Myles et al., 2003), yielded poor results in terms of fluency and story length when compared to SR and did not benefit three of the four participants when compared to HW. Only one participant (Dan) produced lengthier written work, as measured by TWW, with the WP compared to his handwritten stories, although this may have been due to his having more experience with using WP, an accommodation already provided in his classroom and at home. That three of the four participants did not benefit from the use of a WP supported MacArthur and Graham's (1987) findings in which there were no differences between the use of a WP

and handwritten work in story length (TWW) and language complexity for 11 fifth and sixth graders with learning disabilities. In fact, they found that participants actually wrote slower using a WP, relative to using a scribe and handwriting. In contrast, the current study's results refute Bangert-Drowns' (1993) meta-analysis findings that reported that students wrote lengthier texts when using WP. However, it should be noted that Bangert-Drowns' meta-analysis did not include any students with disabilities, only typically developing students who had difficulty with writing. Thus, WP may be more beneficial for students who do not necessarily struggle with the physical demands of writing.

In terms of WP and accuracy (%CWS), the current study yielded mixed results, with one participant benefitting from the use of a WP over handwriting (Cal), another showing decreased accuracy (Dan) using a WP, and the remaining two revealing no difference between WP and HW. This discrepancy is not surprising, given that Hetzroni and Schrieber (2004) found that using a WP resulted in fewer spelling errors for three participants with dysgraphia yet, MacArthur and Graham (1987) found no difference between the use of a WP and handwriting in terms of proportion of grammatical errors to TWW. It is possible, the use of a WP may have decreased Dan's %CWS due to his acknowledgement that he "did not feel like 'going back' and wasting time correcting his mistakes," much like his performance using SR.

Unlike the SR accommodation, the WP had no impact on number of story parts when compared to HW for all participants. These results contradict Bangert-Drowns' (1993) meta-analysis in which there was a slight increase in overall story quality when WP was compared with handwriting, yet support Hollenbeck et al's (1999) and MacArthur and

Graham's (1987) findings in which WP had no impact on story quality. Again, only MacArthur and Graham included children with disabilities.

Mixed results for both SR and WP may also suggest that writing accommodations are idiosyncratic and should be tested prior to being provided to students. They also reveal that these writing accommodations may require additional research in order to provide empirical support for their use before making writing accommodation recommendations for student with AS.

Effectiveness of Combining Accommodations with a Writing Intervention

Berninger (2008), MacArthur (2000), MacArthur and Hollenbeck et al., (1999), and Quinlan (2004) have all suggested that the use of writing accommodations alone will not improve all aspects of writing, particularly writing quality. Current writing accommodation research supports the use of WP to address the physical demands of writing and, thus, improve fluency and story length but it remains unclear as to whether it can improve writing quality (MacArthur & Graham, 1987). The use of SR appears to be more promising in addressing fluency and story quality, as found in this study, although research is sparse (MacArthur & Cavalier, 2004; Quinlan, 2004). Berninger, MacArthur, and Quinlan specifically suggested that the combination of a writing accommodation and a writing intervention that focuses on improving story organization, planning, and overall quality would result in the most successful outcomes for students with writing deficits.

After determining which accommodation would produce the most fluent writing, I examined whether the combination of the SRSD writing intervention with the SR accommodation would have an additive effect on improvements in written language fluency (as measured by TWW and WCS) as well as overall story quality and

completeness (as measured by number of story parts) when compared with combining SRSD with handwriting. Although the SRSD intervention has been used successfully with students with AS (Asaro, 2009; Asaro & Saddler, 2009; Delano, 2007) by increasing story length, the only study to date that combined SRSD with a writing accommodation (SR) included only typically developing students who were considered “less fluent” writers (Quinlan, 2004).

Current study results supported the combined use of the SR accommodation with the SRSD intervention to produce lengthier and more fluent stories when compared to using SRSD with handwriting for students with AS. Consistent with Quinlan’s (2004) findings, this current study found that the SRSD + SR condition also resulted in the highest quality stories that contained the most story parts, when compared to SRSD + HW, which supports the second part of my hypothesis that addressed story completeness. This also provides support for utilizing SRSD for students with AS, possibly because it may address the theory of mind deficits that make it difficult for these students to generate creative thought (e.g., character’s intent, emotional states; Westby, 2004). In addition, the graphic organizer component may have also helped these participants organize their stories, another writing difficulty frequently noted in the literature for students with AS (Fein & Dunn, 2007; Fondacaro, 2001; Griswold et al., 2002). The addition of the SR accommodation to the SRSD intervention may have also served to alleviate any fine-motor constraints and to allow the participant to focus on story content rather than physical production (De La Paz, 1999).

SRSD + SR was also more effective than SR because TWW, WCS, and number of story parts were higher in the SRSD + SR condition than when SR was provided alone.

However, the SRSD + SR condition continued to produce the same level of %CWS as seen with SR alone, therefore suggesting the addition of the SRSD intervention did not improve writing accuracy. This suggests that the SR alone may be solely responsible for the improvements in %CWS for the two participants (Bob and Cal) who struggled with spelling and grammar. The SRSD + SR and the SRSD + HW continued to be differentiated, ultimately revealing the former as the more successful in targeting production-independent elements of writing.

Contrary to SRSD research results (Asaro, 2009; Asaro & Saddler, 2009; Delano, 2007; De La Paz, 1999; Graham & Harris, 2003; Lane et al., 2008; Lienemann et al., 2006; Reid & Lienemann, 2006; Saddler et al., 2004), participants in the current study did not benefit from the SRSD intervention in terms of writing fluency, story length, or accuracy when they hand wrote their stories. This may have been due to ongoing complaints about the physical act of handwriting frequently noted in the literature (Fuentes et al., 2009; Ghazziuddin et al., 1994; Gross, 1994; Lopata et al., 2007; Lee & Park, 2007; Reinhart et al., 2006; Winters-Messiers et al., 2007; Winters-Messiers, 2007) and the participants' subsequent preference for the SR accommodation. However, the current study yielded similar gains to those made in previous SRSD research in terms of story quality and completeness. Thus, participants did not necessarily write more when HW was paired with SRSD, but they wrote better quality stories.

Generalization of Written Language Improvements to Homework Writing Assignments

The final hypothesis was to examine whether the improvements in writing fluency and story completeness would be generalized to participants' homework writing assignments. At one point during each alternating treatment phase, I asked the participants

to complete a homework writing assignment utilizing each accommodation as well as the combination of HW + SRSD and SR + SRSD. To date, I am aware of only one study that sought to generalize results to classroom writing assignments. Asaro (2009) demonstrated that participants with AS successfully transferred gains made using the SRSD intervention to another writing genre. The current study supports this hypothesis and Asaro's findings as all participants' written language improvements transferred to their written work for school. Data showed that SR was differentially more effective than WP and HW across measures and participants and resulted in higher TWW, WCS, and number of story parts than SR and baseline alone. Furthermore, SR and SRSD combined was differentially more effective than SRSD and HW for each writing measure. Thus, this study lends support to Asaro's findings that the SRSD intervention may be helpful for students with AS in a variety of writing genres, particularly when paired with SR.

Limitations

This current study has a few limitations that may be addressed in future research. First, although the use of a WP was not a successful accommodation for these participants, only one participant used WP regularly as an accommodation in school and at home (i.e., Dan). That said, all participants were able to type 10 words per minute, which was considered proficient for this study (Langone et al., 1996). Furthermore, despite Dan's experience using WP, SR and SR + SRSD still resulted in the best outcomes for productivity and story parts for him.

Second, the SRSD intervention lessons used in this study were brief. Although Graham and Harris (2003) indicate that the SRSD intervention does not have a specific timeline in terms of number of lessons, lessons typically involve a great deal of scaffolding

and practice. For example, Asaro (2009) provided SRSD instruction in six sessions and De La Paz (2001) provided instruction over the course of five sessions, followed by four sessions of fading teacher support. In the current study, the steps outlined by Harris et al. (2003) were completed in two sessions. If the participants were provided additional practice and support, gains may have been greater. In addition, participants sometimes made physical complaints (e.g., “my hand hurts”) when handwriting their responses onto their respective graphic organizers during the SRSD + SR condition. This may have been alleviated by creating a template on the computer for the participants to use for their WWW chart, which is used as their graphic organizer. If the participants were given the option to use SR initially to complete their graphic organizers prior to completing their writing probes, perhaps they could have made further gains by utilizing cognitive resources not being tapped by the physical demands of writing (De La Paz, 1999).

Third, it is difficult to assess story quality in a valid and reliable manner (Greenberg, 1992). Tindal and Parker (1989) noted that many of the subjective writing measures have poor reliability and that when those measures are modified to improve reliability, they tend to become less valid. Although the number of story parts has been used in recent SRSD studies (Asaro, 2009; Delano, 2007), it is specific to the graphic organizer utilized in this intervention. Thus, the use of this measure may have produced inflated results given the match between this variable and the intervention.

Fourth, although the SR accommodation proved to be helpful for these students, it is not without limitations. The most current version has the best voice recognition accuracy rates for adults to date, but there are no data on accuracy rates for children (MacArthur & Cavalier, 2004). In addition, it is possible that voice recognition accuracy may have been

compromised by these students' odd prosody, a speech characteristic of many children with AS (Attwood, 2006; Barnhill, 2001a). Thus, regardless of their preference for using this software, participants sometimes reported some frustration when the software did not correctly interpret their statements.

Fifth, although the use of four participants in a single subject study is adequate, systematic replication is required before these data are generalized (Horner et al., 2005). In future research, a multi-group design could be implemented including participants with AS who have writing difficulties. A control group (HW), an SR group, and an SR + SRSD group could be compared using the same variables as those in the current study. This may provide the additional empirical support for the combination of SR with SRSD for this population. Another potential study may be to compare the writing challenges of the student with AS to those with writing learning disabilities. If similar, the combination of SR with SRSD may be useful for that population as well.

Future Research and Implications

The current findings suggest some areas that should be included in future research. Since WP, a commonly recommended accommodation for students with AS, was not found to be an effective way to accommodate handwriting and expressive writing deficits, future research should focus on exploring more effective assistive technology accommodations, such as SR. At this time, research supporting SR for students with written language difficulties is promising but sparse. Although SR technology has become quite advanced, reporting accuracy rates between 90% and 98% for adults (MacArthur & Cavalier, 2004), there are no accuracy rates reported for children. Future research should study child accuracy rates and explore improving SR accuracy for children as well as for

special populations like those with AS, due to their atypical speech patterns, pitch, and tones (Attwood, 2006). In addition, future research should explore the use of SR with other populations, such as English Language Learners or those with oral language difficulties. Participants in the current study often had to modify their atypical speech patterns (i.e. speak slower, modify pitch, enunciate clearly) to enable the SR software to accurately record their stories. Additional research in this area may address whether the SR accommodation could possibly be used as an intervention for these populations.

Given the anecdotal evidence as well as the current study's social validity outcomes that suggest children with AS do not like handwriting, future research should examine whether attitudes towards writing may serve as a mediator for outcomes. For example, it would be interesting to note whether the use of SR could possibly improve attitudes towards the writing process by alleviating the physical strain of handwriting and that those attitudes may further improve writing outcomes. In addition, it would be important to find supporting evidence for the notion of "freeing up cognition" (De La Paz, 1999) by accommodating for their writing deficits with assistive technology to enable them to produce more accurate and creative work.

Another possible area to explore is the use of a timer for improving writing speed for children with AS, a common difficulty reported by a number of researchers (Church et al., 2000; Griswold et al., 2002). It was noted that some of the participants (Abe and Dan) asked for the timer to be placed in front of them so that they could "keep track" of time. When asked about the timer, they both indicated that it helped them write faster. Interventions such as sentence combining, which teaches students to construct more complex sentences, and prewriting, an intervention designed to assist students with

generating novel ideas through brainstorming may be good interventions (Graham & Perin, 2007) to explore for this particular population given their difficulties with sentence complexity (Myles et al., 2003) and theory of mind/creative thought deficits (Baron-Cohen, 2001). Also, since the students in this current study evidenced idiosyncratic writing deficits, some students may require specific interventions addressing spelling or grammar, which is not specifically targeted in SRSD (Graham & Harris, 2003).

Given that the most positive outcomes resulted from the combination of the SR accommodation and the SRSD writing intervention, future research is needed to provide additional support for this particular “package.” It would be interesting to know if the SR and SRSD combination approach would also work for other students with writing problems or if this particular combination is unique to children with AS, who seem to require the additional assistance with fine-motor tasks. Also, researchers should specifically examine SRSD clinical dosage. Studies should examine whether increasing the number and/or length of SRSD sessions would have a positive impact on writing outcomes (i.e. integrating SRSD into the students’ writing curriculum) or if fewer sessions would be sufficient when accompanied by booster sessions.

Future researchers may also want to consider conducting brief experimental analyses examining potential effectiveness of other empirically supported accommodations and writing interventions to determine the most effective approach (Berninger et al., 2008; MacArthur, 2000; MacArthur and Hollenbeck et al., 1999; Quinlan, 2004). The current study contributes to a line of research that have begun to explore possible effective combinations for various populations (Delano, 2007, e.g. video self-modeling paired with SRSD; Quinlan, 2004, e.g. SR paired with SRSD). The outcome suggests that merely

accommodating writing challenges is simply not sufficient to address the complexities of written language deficits.

Appendix A. Recruitment letter to school psychologists

Dear colleagues,

My name is Ariane Schneider and I am a student in the Educational Psychology Ph.D. program at the Graduate Center of the City University of New York (CUNY). I am also a school psychologist looking to recruit 4 students with Asperger's Syndrome (AS) for a study that I am conducting entitled "Comparing and combining accommodation and remediation interventions to improve written language performance of children with AS."

I am asking that you send home the attached consent letters that describe my study to parents who may be interested in having their son/daughter participate. The following is a summary of my research study, as well as the specific criteria for inclusion.

Purpose:

1. Which accommodation (word processor or speech recognition technology) will be more successful in improving the written language performance for students with AS?
2. Will the addition of a specific writing intervention (SRSD) further improve writing when paired with the more successful accommodation?

Participants: *4 students, from grades 4-6, formally diagnosed with AS, who have a history of writing difficulties, and have basic typing skills.*

Setting: The study will be conducted in the students' homes (after school), so as not to interfere with the students' school schedule. The study will consist of approximately 15 30-minute sessions.

Interventions:

1. Computer Accommodation: This accommodation would involve the student utilizing the WordPad program on the researcher's computer to write 3 minute stories.
2. Speech Recognition Technology Accommodation: DragonNaturally Speaking Standard, 10th version will be utilized on the researcher's laptop for the student to verbalize his/her stories.
3. Self-Regulated Strategy Development (SRSD): This is a writing intervention that uses self-instruction, modeling, guided practice and graphic organizers to improve a student's writing skills.

Procedures: Students will be asked to write 3-minute stories based on a suggested topic. Accommodations will alternated and compared. Next, the most successful accommodation will be paired with the SRSD intervention to determine if there is further improvement.

Measures: The following assessments will be conducted by the researcher and research assistant prior to, during, and after the interventions.

Dependent Measures: Curriculum Based Measurement (CBM) will be used to measure written expression. The 4 variables will be total words written, number of words in a complete sentence, percentage of correct word sequences, and number of story parts.

Benefits: These research findings may add to the research describing ways to help reduce the academic problems that children with AS sometimes have. *At this time, there has not been any empirically based research* done addressing the potential benefits of a particular writing intervention paired with assistive technology for students with AS.

If you have any questions regarding this study, please e-mail me at Aschnei4@schools.nyc.gov. Thank you very much.

Sincerely,

Ariane Schneider
School Psychologist

Appendix B. Parent recruitment letter

Dear parents,

My name is Ariane Schneider, a school psychologist and I am doing research with students with Asperger's Syndrome (AS) for my doctoral dissertation at the Graduate Center of the City University of New York (CUNY). I am looking to recruit 4 students with AS (grades 4-6) who are also struggling with writing. I have enlisted the assistance of the school psychologists in my region to help me find potential students, but they will not be involved in my research study.

In my study, I intend to compare 2 computer accommodations (speech recognition technology and use of a word processor) and a specific writing intervention to see what combination works best in improving writing skills for students with AS.

The study will be conducted in students' homes (after school), so as not to interfere with their school schedule. I will be working with the student individually, using my laptop computer on various writing tasks. It is anticipated that the study will consist of approximately 15 30-minute sessions.

All information will be kept confidential and participation is completely *voluntary*. Your decision as to whether you would like your child to participate will have no effect on your child's standing at his/her school and will not impact the relationship that your child may have with his/her school psychologist. You may withdraw consent for your child's participation at any time during the course of the study.

If you should have any questions about my study or you decide that you would like your child to participate, please contact me at Aschnei4@schools.nyc.gov. Thank you very much.

Sincerely,

Ariane Schneider, M.S.Ed
School Psychologist

Appendix C. Parent consent form

Consent Form

My name is Ariane Schneider and I am a student in the Educational Psychology Ph.D program at the Graduate Center of the City University of New York (CUNY), and Principal Investigator of this project, entitled “Comparing and combining accommodation and remediation interventions to improve written language performance of children with Asperger’s Syndrome.” This is a research study that compares three writing interventions to see which may better address your child’s writing difficulties.

Purpose:

- This study is expected to provide students with Asperger’s Syndrome important strategies to assist with writing skills and hopefully, allow your child to experience increased success in the area of writing.
- I would like permission to work with your son/daughter to compare 3 writing interventions to see how well each improves written language skills.

Procedures: Since I do not wish to interfere with your son/daughter’s school schedule, the research will be conducted in your home, at times that are convenient for your family.

- The research project will involve working with your child for at least 15 30-minute sessions. Treatment sessions will last 6-8 weeks.
- With your permission, some of these sessions will be audio-taped so that I can have a colleague make sure that I provide all children in the study with the same instructions. The tapes will only be heard by me, my colleague, and my advisors. When the study is completed, tapes will be destroyed.
- All information will be confidential, and will be stored in a locked file cabinet, to which only I, and my advisors, have access.
- At any time, you may withdraw consent for your child’s participation and any information collected will be destroyed.
- There will be approximately 4 children taking part in this study.

Benefits of Participation:

- There is a possibility that the writing interventions will significantly improve your child’s writing skills. Since the writing process has been difficult for your child, this study may provide the help that your child needs and hopefully make him/her feel more confident about his/her writing.
- These research findings may add to the research describing ways to help reduce the academic problems that children with Asperger’s Syndrome sometimes have.
- The risk involved in this study may involve some frustration during writing tasks, though they are quite brief (3 minutes). If your child should express frustration and or appear fatigued, he/she will be told that he/she can take a break in between sessions.

- Your child will also be told that he/she can withdraw from participation at any time. In addition, your child will be reassured that work can be checked on the computer after he/she completed his/her written work.

I may publish results of this study, but names of people, or any identifying characteristics, will not be used in any of the publications. If you would like a copy of this study, please provide me with your name and address and I will happily send you a copy in the future.

If you have any questions regarding this research, you can contact me at aschneider@gc.cuny.edu, or my advisor, Dr. Tryon at Gtryon@gc.cuny.edu.

Thank you for your child's participation in this study. I will give you a copy of this consent form for your records.

I have read and agree that my child can participate in the research project. I understand that some of the sessions will be audiotaped, which is mandatory for participation.

Participant's Guardian's Signature date

Investigator's Signature date

Appendix D. Student assent script

Student Assent Form

Hello _____, my name is Ariane Schneider. I am a student at the City University of New York and would like to talk to you about a research project that I am doing. I hope to teach boys and girls just like you new ways of writing stories so it won't be such a hard thing to do. I would be coming to your home about 15 different times to teach you and when we work together, you can ask for a break whenever you need one. Also, if you don't want to work with me anymore, you can tell me or your parents and that would be OK. All of the work that we do together is private and will be locked in my file cabinet so that no one will be able to see your work, except for me and my teachers who help me. Sometimes, I will use a tape recorder to tape us working together so that one of my friends can check my work.

Do you have any questions? Would you like to work with me?

Circle Student's Response: **Yes** **No** **I don't know**

Investigator's Signature

Date

Appendix E. WWW graphic organizer

W-W-W graphic organizer

Who is the main character? _____

When does the story take place? _____

Where does the story take place? _____

What does the main character do or want to do? What do other characters do? _____

What happens then? What happens with other characters? _____

How does the story end? _____

How does the main character feel? How do other characters feel? _____

Appendix F. Sample story 1

The Tiger's Whiskers

A long time ago (When), there was a woman who lived with her son (Who) in the forest (Where). One day, her son got very sick. The woman was very sad (Feelings) and wanted her son to get well (What she wanted to happen). She tried everything she could think of, but nothing worked. At last, she remembered that medicine from a tiger's whisker would help him get well. So the woman set out to get a tiger's whiskers. She went to a tiger's cave and put food in front of the cave and sang soft music. The tiger came out, ate the food, and thanked the woman for the music and food. The woman asked him for one of his whiskers and ran home (What happened). The woman's son got well (Ending) and the woman felt very happy (Feeling).

Appendix G. Sample story 2

Albert the Fish

On a warm, sunny day two years ago (When), there was a big gray fish named Albert (Who). He lived in a big icy pond near the edge of town (Where). Albert was swimming around the pond when he spotted a juicy worm on top of the water. Albert knew how good worms tasted and wanted to eat this one for dinner (What he wanted to do). So he swam very close to the worm and bit into him. Suddenly, Albert was pulled through the water into a boat (What happened). He had been caught by a fisherman (Ending). Albert felt sad (Feelings) and wished he had been more careful.

Appendix H. Sample story 3

The Lost Rabbit

After school yesterday afternoon (When), a 4th grader named Trish (Who) and her best friend Mary, opened her front door to go out to the park (Where). When they opened the front door, they saw a little white rabbit sitting on the door mat. They thought the rabbit was very cute and decided to pet it and pick it up. With Trish's mom's help, they decided to get some carrots from the fridge and give it some food in case it was hungry. As the rabbit was eating, the girls thought that the rabbit might be lost and thought of a plan to find its owner (What the characters do). The girls start making signs describing the rabbit and Mary draws a picture of the rabbit on the signs (What happens then). The girls put the signs up on trees on their block with their phone number on it. That evening, Trish's mom got a phone call from a neighbor, Ms. Ebbert, who said that her daughter had lost her new rabbit and was very sad. Ms. Ebbert then came to Trish's house with her daughter and was very excited (Feelings) that Trish and Mary found her rabbit. The little girl was so happy and excited that she gave Trish the biggest hug she ever got! Trish was so happy that she could help this little girl (End).

Appendix I. Intervention Rating Profile – 15
(Martens, Witt, Elliott, & Darveaux, 1985)

The purpose of this questionnaire is to obtain information that will aid in the evaluation of the _____. Please circle the number which best describes your agreement or disagreement with each statement.

1 = Strongly disagree 2 = Disagree 3 = Slightly disagree 4 = Slightly agree
5 = Agree 6 = Strongly agree

- | | | | | | | |
|---|---|---|---|---|---|---|
| 1. The _____ would be an acceptable intervention to improve writing skills. | 1 | 2 | 3 | 4 | 5 | 6 |
| 2. Most teachers would find the _____ appropriate for improving writing skills. | 1 | 2 | 3 | 4 | 5 | 6 |
| 3. The _____ should prove effective in improving writing skills. | 1 | 2 | 3 | 4 | 5 | 6 |
| 4. I would suggest the use of the _____ to other teachers. | 1 | 2 | 3 | 4 | 5 | 6 |
| 5. The writing difficulties are severe enough to warrant use of the _____. | 1 | 2 | 3 | 4 | 5 | 6 |
| 6. Most teachers would find the _____ suitable for improving writing skills. | 1 | 2 | 3 | 4 | 5 | 6 |
| 7. I would be willing to use the _____ in the classroom setting. | 1 | 2 | 3 | 4 | 5 | 6 |
| 8. The _____ would not result in negative side-effects for children. | 1 | 2 | 3 | 4 | 5 | 6 |
| 9. The _____ would be appropriate for a variety of children. | 1 | 2 | 3 | 4 | 5 | 6 |
| 10. The _____ is consistent with those I have used before in the classroom setting. | 1 | 2 | 3 | 4 | 5 | 6 |
| 11. The _____ is a fair way to improve writing skills. | 1 | 2 | 3 | 4 | 5 | 6 |
| 12. The _____ is reasonable for improving writing skills. | 1 | 2 | 3 | 4 | 5 | 6 |

1 = Strongly disagree 2 = Disagree 3 = Slightly disagree 4 = Slightly agree
5 = Agree 6 = Strongly agree

13. I like the procedures used in the _____ 1 2 3 4 5 6

14. The _____ is a good way to improve writing skills. 1 2 3 4 5 6

15. Overall, the _____ would be beneficial for the
classroom. 1 2 3 4 5 6

Appendix J. Children's Intervention Rating Profile

Name _____ Date _____

What Did You Think?

| | | I do not agree | | | | I agree | |
|---|--|----------------|---|---|---|---------|---|
| 1 | _____ was fair. | 1 | 2 | 3 | 4 | 5 | 6 |
| 2 | Using _____ was too hard. | 1 | 2 | 3 | 4 | 5 | 6 |
| 3 | Using _____ may cause problems with my friends. | 1 | 2 | 3 | 4 | 5 | 6 |
| 4 | There are better ways to improve writing than using _____. | 1 | 2 | 3 | 4 | 5 | 6 |
| 5 | _____ is good to use with other students. | 1 | 2 | 3 | 4 | 5 | 6 |
| 6 | I like using _____ | 1 | 2 | 3 | 4 | 5 | 6 |
| 7 | I think using _____ will help me to do better in school. | 1 | 2 | 3 | 4 | 5 | 6 |

Appendix K. Protocol

Materials:

- ④ Pencil(s) ④ self-statement chart ④ POW chart ④ W-W-W chart
- ④ lined paper ④ two sample stories for training session (*The Tiger's Whiskers*,
Albert the Fish) ④ computer ④ stopwatch ④ reading passage
for typing test ④ researchers sample story (*The Lost Rabbit*)

Typing Test:

④ State **“I would like you to type this story. You will have three minutes.**

Type as quickly and carefully as you can. Are you ready? Begin typing.”

The following passage will be placed in front of the student:

Dolphins live together in groups. These groups are called pods or herds. A pod has up to 40 dolphins. A herd can have up to several hundred! Beginning at birth, each dolphin depends on the other dolphins in the group for survival. When a dolphin is born, its mother and other dolphins take care of it. A baby dolphin is called a calf. It is born underwater and usually comes out tail first. It can't swim at first, so its mother pushes it to the surface to breathe. Sometimes, another dolphin helps the mother do this. Calves stay close to their mothers. When calves are hungry, they drink milk from their mother's body. A dolphin baby needs to nurse three to eight times an hour. It nurses for over a year. In just a few weeks, the calf will double in size.

Dolphins spend a lot of time playing together. They even seem to have best friends. They chase each other. They make circles in the water with bubbles and try to swim through them. They leap out of the water and fall back in. They slap their tails in the water to get attention. Since dolphins like the waves boats make, they sometimes swim alongside boats. Baby dolphins are especially playful. When they play, they throw seaweed at each other. They balance rocks on their flippers. All this play helps them practice skills they will use later for swimming and hunting.

Phase 1 - Baseline:

⌚ State **“Here is a pencil and some sheets of paper for your writing. I want you to write a story. I am going to read a sentence to you first, and then I want you to write a story about what happens. You will have one minute to think about the story you will write and then have three minutes to write it. Please do your best work. If you don’t know how to spell a word, you should guess. Are there any questions? For the next minute, think about (insert story starter). At the end of the minute, I will say ‘begin writing.’”**

If the student discontinues writing prior to the three minutes, encourage him/her to continue writing. At the end of three minutes, state **“stop and put your pencil down.”** Baseline data should be collected for at least three sessions and until baseline data are stable.

Phase 2 – Alternating Treatments (handwriting, WP, & SR)

SR Training

⌚ For SR training, state **“I would like you to read two stories into the microphone.”**

Choosing Treatment Conditions:

⌚ State **“I am going to put 3 pieces of paper in this hat which has three different ways you are going to write your story. They will say ‘handwriting,’ ‘WP,’ or ‘SR.’ If you choose the ‘handwriting’ paper, you will write your story like we practiced. If you chose the ‘WP’ paper, you will prepare to write your story like we practices but you will type it on the computer. If you choose the ‘SR’ paper, you will prepare to write your story like we practiced but you will talk into the microphone instead of using a pencil and paper. We will choose a paper each time before I give you your story starter.”** (Student chooses paper. Limit to 3 consecutive times per treatment.).

Alternating Treatments

⌚ State “I want you to compose a story. I am going to read a sentence to you first, and then I want you to compose a story about what happens. You will either hand write the story, use the keyboard, or tell your story into the microphone, depending on the paper you chose from the hat. You will have one minute to think about the story you will write and then have three minutes to compose it. Please do your best work. If you don’t know how to spell a word, you should guess. Are there any questions? For the next minute, think about (insert story starter). Begin composing your story.”

Phase 3 – Replication (SR)

⌚ State “I want you to compose a story. I am going to read a sentence to you first, and then I want you to compose a story about what happens. You will tell your story into the microphone. You will have one minute to think about the story you will write and then have three minutes to compose it. Please do your best work. If you don’t know how to spell a word, you should guess. Are there any questions? For the next minute, think about (insert story starter). Begin composing your story.”

Phase 4 – Alternating Treatments (SRSD + handwriting and SRSD + SR)

Training for SRSD: (training should occur in two 30-min sessions)

Training Session #1

⌚ *Self-Statements:* State “Sometimes when we write, we get ‘stuck.’ I would like to help you think of some things that you can say to yourself when this happens. Here is a piece of paper with the following statements ‘to think of good ideas, while I work, and to check my work.’ What can be good thing to say to yourself to help you think of good ideas? (encourage the student to think of at least two self-statements and record on sheet. If student is unable to think of a self-statement, provide example ‘Take my time and a good idea will come to me.’). **What can you say to yourself while you work?** (encourage the student to think of at least

two self-statements and record. If student is unable to think of a self-statement, provide example ‘Slow down and look at my W-W-W chart for help’). **What can you say to yourself when you are checking your work?** (encourage student to think of at least two self-statements and record on sheet. If student is unable to think of a self-statement, provide example ‘did I include the answers to my 7 questions?’).

Now that you have your self-statements, let’s put them on the desk so you can look at them while you work.”

④ *Introduce POW mnemonic:* State **“I am going to teach you some tricks for writing. First, we’re going to learn the POW strategy, or trick, that good writers use when they write. POW stands for ‘pick my idea, organize my notes, and write and say more.’ One way you can remember POW is that it gives you power when you write. Before you begin your writing, POW can help remind you the steps in good writing.**

④ *Introduce W-W-W strategy:* State **“Let’s find out what the parts of a good story are. Here is a list of important questions you should answer to help organize your writing after picking your idea** (lay out the W-W-W graphic organizer and read the seven questions). **I am going to read a story called ‘The Tiger’s Whiskers’ to find out if the writer used all of the parts of a good story.** (Give the student a copy of the story without the W-W-W hints). **Listen carefully.**

The Tiger’s Whiskers

A long time ago (When), there was a woman who lived with her son (Who) in the forest (Where). One day, her son got very sick. The woman was very sad (Feelings) and wanted her son to get well (What she wanted to happen). She tried everything she could think of, but nothing worked. At last, she remembered that medicine from a tiger’s whisker would help him get well. So the woman set out to get a tiger’s whiskers. She went to a tiger’s cave and put food in front of the cave and sang soft music. The tiger came out, ate the food, and thanked the woman for the music and food. The woman asked him for one of his whiskers and ran home (What

happened). The woman's son got well (Ending) and the woman felt very happy (Feeling).

④ **Let's go over the story together to see if we can find the answers to our seven questions.** (Begin reading the story to the student and pause at each W-W-W hint and state **'here is the answer to this question'** and point to the student's copy of the story and underline correct answer. For example, when reading the phrase *'a long time ago,'* pause and state **'this is the answer to the question 'when does my story take place' and underline on student's copy).** **I'm going to fill in our W-W-W chart with each of the answers as I read** (Fill in W-W-W graphic organizer in front of student with correct responses).

④ **Some other important things to know about good writing is that you can have more than one character and you can tell more about when and where your story is taking place. If you look at your POW reminder, it says 'write and say more.'** This means that you can have more than one thing happening and you can tell more about how a character is feeling. A good story has all seven parts, makes sense, and is fun for me to write and for others to read.

Let's try another story. This time, I would like for you to try to find the answers by yourself. I am here to help you as you fill in your W-W-W chart. Here is a story called 'Albert the Fish.' (Place the story in front of the student without the W-W-W hints and a W-W-W graphic organizer). **Please read the story and then find the answers to the seven questions. Make sure you write them on your W-W-W chart.**

Albert the Fish

On a warm, sunny day two years ago (When), there was a big gray fish named Albert (Who). He lived in a big icy pond near the edge of town (Where). Albert was swimming around the pond when he spotted a juicy worm on top of the water. Albert knew how good worms tasted and wanted to eat this one for dinner (What he wanted to do). So he swam very close to the worm and bit into him. Suddenly, Albert was

pulled through the water into a boat (What happened). He had been caught by a fisherman (Ending). Albert felt sad (Feelings) and wished he had been more careful.

④ **Let's see if you could find all of the important answers to the seven questions.** (Check the student's W-W-W graphic organizer and correct if necessary).
You did terrific work and I think you are ready to write your own story!"

Training Session #2

④ *Model:* State **"Now I am going to show you how we can use our strategies to write a good story. I will write a story and show you how I use the strategies and then you will write a story on your own. Before I begin writing, I am going to put the self-statements, my POW reminder and my W-W-W chart on my desk** (demonstrate by placing self-statements and POW reminders near the top of the desk and the W-W-W graphic organizer in the middle of desk). **Here is my story starter 'One day, I opened up my front door and a little rabbit was sitting on the door mat.'** Well, if I look at my POW reminder, I know I have to pick my idea. **I think I will write about a girl being excited about finding the rabbit and try to figure out if it is missing. Now I have to organize my ideas with my W-W-W chart.** (Below are the seven questions and the answers I will model for student. Read each question aloud, provide answer, and then record on W-W-W sheet).

W-W-W graphic organizer responses

Who is the main character? A little girl named Trish

When does the story take place? Yesterday afternoon.

Where does the story take place? In Brooklyn, New York

What does the main character do or want to do; what other characters do?

Trish picks up the rabbit and brings it inside the house and thinks of ways to help find its owner. Her best friend helps her.

What happens then? What happens with the other characters? Trish begins making posters about the lost rabbit and puts them on trees on her block. Her best friend is a good artist and draws a picture of the rabbit.

How does the story end? A neighbor calls Trish's house and is very happy that Trish found her daughter's new rabbit.

How does the main character feel; how do other characters feel? Trish feels very happy that she was able to give the rabbit back to the little girl. The little girl was so happy that she gave Trish the biggest hug she ever had.

🕒 **Now that I filled out my W-W-W chart, I am ready to write my story. While I write, I am going to look at my self-statements if I get stuck. Since I have organized my notes, I am ready to write (point to the POW reminder). Here I go. I am going to place a check next to the question when I've answered it in my story. (talk aloud as you write your story):**

The Lost Rabbit

After school yesterday afternoon (When), a 4th grader named Trish (Who) and her best friend Mary, opened her front door to go out to the park (Where). When they opened the front door, they saw a little white rabbit sitting on the door mat. They thought the rabbit was very cute and decided to pet it and pick it up. With Trish's mom's help, they decided to get some carrots from the fridge and give it some food in case it was hungry. As the rabbit was eating, the girls thought that the rabbit might be lost and thought of a plan to find its owner (What the characters do). The girls start making signs describing the rabbit and Mary draws a picture of the rabbit on the signs (What happens then). The girls put the signs up on trees on their block with their phone number on it. That evening, Trish's mom got a phone call from a neighbor, Ms. Ebbert, who said that her daughter had lost her new rabbit and was very sad. Ms. Ebbert then came to Trish's house with her daughter and was very excited (Feelings) that Trish and Mary found her rabbit. The little girl was so happy and excited that she gave Trish the biggest hug she ever got! Trish was so happy that she could help this little girl (End).

Look how I wrote my story using my W-W-W chart, my self-statements, and the POW reminder. When I got stuck, I looked at my helpful self-statements and the POW reminder. I think you are ready to write your own story.

④ *Independent practice:* State “I want you to write a story. I am going to read a sentence to you first, and then I want you to write a short story about what happens. Please fill out your W-W-W chart, look at your self-statements and POW reminder if you get stuck. After you fill out your W-W-W chart, you should begin writing your story. Do your best work and if you don’t know how to spell a word, you should just guess. I am here to help you if you forget how to use your strategies. Here is your story starter: ‘This weekend I am going to a birthday party.’ Place your self-statements, POW reminder and W-W-W chart on your desk and begin.”(watch the student work, prompt him/her when needed).

Excellent work! Let’s check your story to see if you answered all of your questions. (Check work, correct if necessary). Now you have what it takes to be a great writer!”

Choosing Treatment Conditions:

④ State “I am going to put 2 pieces of paper in this hat which has two different ways you are going to write your story. One will say ‘SRSD + handwriting’ and the other will say ‘SRSD + SR.’ If you choose the ‘SRSD + handwriting’ paper, you will write your story like we practiced. If you choose the ‘SRSD + SR’ paper with, you will prepare to write your story like we practiced but you will talk into the microphone instead of using a pencil and paper. We will choose a paper each time before I give you your story starter.” (Student chooses paper. Limit to 3 consecutive times per treatment.).

Alternating Treatments:

④ State “I want you to write a story. I am going to read a sentence to you first, and then I want you to write a short story about what happens. Please put your self-statements, your POW reminder and WWW chart on your desk. Don’t forget



to use your POW reminders and self-statements if you get stuck. When you are finished filling out your WWW chart, state “I’m done.” At that time, I will let you know when you could begin writing your story. You will either be writing your story using pencil and paper or by talking into the microphone, depending on the piece of paper you chose from the hat. You will have 3 minutes to write your story. Do your best work and if you don’t know how to spell a word, you should guess. Are there any questions? (If the participant discontinues writing before the three minutes have elapsed, the researcher will encourage him/her to continue writing. After 3 minutes, the researcher will state “stop.”

Phase 5 – Replication (SRSD + SR)





⌚ State “I want you to write a story. I am going to read a sentence to you first, and then I want you to write a short story about what happens. Please put your self-statements, your POW reminder and WWW chart on your desk. Don’t forget to use your POW reminders and self-statements if you get stuck. When you are finished filling out your WWW chart, state “I’m done.” At that time, I will let you know when you could begin writing your story. This time, you will be writing your story by talking into the microphone. You will have 3 minutes to write your story. Do your best work and if you don’t know how to spell a word, you should guess. Are there any questions? (If the participant discontinues writing before the three minutes have elapsed, the researcher will encourage him/her to continue writing. After 3 minutes, the researcher will state “stop.”

Appendix L. Procedural integrity checklist







Typing Test

-  Researcher read “typing test” instructions according to protocol
-  Researcher allowed 3 minutes for typing test





Phase 1 - Baseline

-  Researcher read “baseline” instructions according to protocol
-  Researcher allowed 3 minutes for participant story writing
-  Researcher provided 5 minute break between stories
-  Researcher collected at least 3 baseline data points




Phase 2 - Alternating Treatments (Handwriting, WP, & SR)



-  Researcher read “SR training” instructions according to protocol
-  Researcher read “choosing treatment conditions” instructions according to protocol
-  Researcher read “alternating treatment” instructions according to protocol
-  Researcher provided 3 minutes for participant story writing
-  Researcher provided 5 minute break between stories
-  Researcher did not allow one treatment to be repeated for more than three consecutive times

Phase 3 - Replication (Handwriting & SR)



-  Researcher read “replication” instructions according to protocol
-  Researcher provided 3 minutes for participant story writing
-  Researcher provided 5 minute break between stories
-  Researcher did not allow one treatment to be repeated for more than three consecutive times

Phase 4 - SRSD Training Session #1






-  Researcher read “self-statements” instructions according to protocol
-  Researcher read “POW” instructions according to protocol
-  Researcher read “WWW” instructions according to protocol

-  Researcher read “The Tiger’s Whiskers” and helped participant fill in WWW chart according to protocol
-  Researcher read “Albert the Fish” and allowed participant to create his or her own WWW chart according to protocol



Phase 4 - SRSD Training Session #2

-  Researcher read “The Lost Rabbit” instructions and modeled completing the WWW chart according to protocol
-  Researcher read “independent practice” instructions according to protocol

Phase 4 – Alternating Treatments

-  Researcher read “choosing treatment conditions” instructions according to protocol
-  Researcher read “alternating treatments” instructions according to protocol
-  Researcher provided 3 minutes for participant story writing
-  Researcher provided 5 minute break between stories
-  Researcher did not allow one treatment to be repeated for more than three consecutive times

Phase 5 – Replication

-  Researcher read the “replication” instructions according to protocol
-  Researcher provided 5 minute break between stories

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