2018

Characterization of Cross-Genre Writing Skills in Children with and Without Autism Spectrum Disorders: The Role of Language, Handwriting, and Cognitive Processing

Elizabeth Hilvert

LOYOLA UNIVERSITY CHICAGO

CHARACTERIZATION OF CROSS-GENRE WRITING SKILLS IN CHILDREN WITH AND WITHOUT AUTISM SPECTRUM DISORDERS: THE ROLE OF LANGUAGE, HANDWRITING, AND COGNITIVE PROCESSING

A DISSERTATION SUBMITTED TO

THE FACULTY OF THE GRADUATE SCHOOL

IN CANDIDACY FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

PROGRAM IN DEVELOPMENTAL PSYCHOLOGY

BY

ELIZABETH HILVERT

CHICAGO, IL

AUGUST 2018

ACKNOWLEDGEMENTS

I would like to thank all of the people who made this dissertation possible, starting with my wonderful professors in the Psychology Department at Loyola University Chicago, as well as my outside committee members. Dr. Perla Gamez proved an excellent sounding board for me from the beginning of my time here, and reminded me to always consider the theoretical framework guiding my research questions. Dr. Molly Losh provided me with valuable perspective and knowledge on issues of narrative development in children with Autism Spectrum Disorders. Dr. Cheryl Scott served as an excellent mentor in the area of naturalistic language sampling; her guidance on the coding and analysis of written text was invaluable. Finally, I would like to thank my committee chair, Dr. Denise Davidson. Her sage advice has kept me on track at all stages of my graduate career, and allowed me to achieve my career aspirations. Most importantly, her friendship and encouragement have made all the difference in this lengthy and laborious process.

I would also like to thank Loyola University Chicago for providing the funds with which to complete my research and writing. The Child and Family Assistantship in the 2016-2017 school year allowed me to make discernable progress on my dissertation proposal, and an Arthur J. Schmidt Dissertation Fellowship in Leadership and Service for the 2017-2018 school year allowed me to focus on collecting data and the writing process. I would also like to recognize, with great appreciation, the Research Mentoring Program and Graduate Research Funding, which provided me with the resources to complete my research.

Finally, I would also like to thank a number of undergraduate research assistants in the Psychology Department for their help with data collection and coding—Natalie Ingravallo, Peyton Holleran, Marissa Cassar, and Alison Levahn.

TABLE OF CONTENTS

LIST OF TABLES

ABSTRACT

It has been estimated that writing is one of the most significant academic problems for children with Autism Spectrum Disorder (ASD), with as many as 60% of children having a learning disability in writing (Mayes & Calhoun, 2008). The majority of evidence demonstrating this achievement gap, however, comes from research finding global writing deficits, using standardized tests. As a result, a number of questions remain about how the texts constructed by children with ASD specifically align or deviate from typical development. For instance, do these texts differ in terms of vocabulary, grammar, or structure? Are children with ASD better at writing in a particular genre? Additionally, the mechanisms that influence writing development in children with ASD are still unclear. Therefore, in the present study we (1) comprehensively characterized the cross-genre (i.e., personal narrative, expository) writing development of 8- to-14-year-old children with and without ASD; and (2) examined how language, handwriting ability, and cognitive processing contribute to written expression. Our findings revealed that children with ASD wrote less and made more grammatical errors in their sentences across writing genres than neurotypical (NT) children. When examining overall quality, children with ASD only differed from neurotypical children on their narrative texts. In contrast, writing high quality expository essays was an area of relative strength for children with ASD compared to NT children. Contrary to expectations, children made few significant style distinctions between personal narrative and expository writing. Current analyses also indicated that oral language skills, handwriting ability, theory of mind, and executive functioning each play a role in a variety

of written expression skills in children with and without ASD. For example, theory of mind knowledge appeared to be especially important for the quality of writing among children with and without ASD. These results have important implications for educational instruction as well as the development of writing interventions.

CHAPTER ONE

INTRODUCTION

Autism Spectrum Disorder (ASD) is a pervasive neurodevelopmental disorder that is characterized by social communication impairments (i.e., deficits in verbal and non-verbal communication, social reciprocity, peer relationships) and marked by an increase in restrictive and repetitive behaviors (American Psychiatric Association, 2013). Children with ASD often present with a wide-array of intellectual abilities, ranging from those with diagnosed intellectual disabilities (i.e. low-functioning) to those with average or above average intelligence (i.e., high-functioning; Christensen et al., 2016). As a result of these diagnostic characteristics and intellectual differences, historically, children with ASD have not been provided equal access to the general education curriculum. Fortunately, current legislation, and evidence for the benefit of inclusion, has led to an increasing number of children with ASD, especially those without intellectual disabilities, to be mainstreamed, or educated in general education classrooms (Bock, Borders, & Probst, 2016; Harding, 2009). In light of this, a small, but growing body of research has started to explore the learning needs of children with ASD. These studies have shown that the academic achievement of high-functioning children with ASD can range widely, from severely impaired to exceptional (e.g., Brown, Oram-Cardy, & Johnson, 2013; Griswold, Barnhill, Smith-Myles, Hagiwara & Simpson, 2002; Mayes & Calhoun, 2003, 2006, 2007, 2008). One area of academics that has been identified as particularly challenging for children with ASD is written expression, with as many as 60% of children with ASD having a learning

disability in written expression compared to 6% in reading and 23% in math (Mayes & Calhoun, 2008).

Writing is a ubiquitous skill that is essential across the lifespan. Effective writing skills are necessary at all levels of schooling in order for students to demonstrate their acquired knowledge in the classroom (Mercer & Mercer, 2005). With the increasing prevalence of technology, written expression skills are also important outside of the classroom for obtaining a high-skill, high-wage job (e.g., producing written reports; College Entrance Examination Board, 2004), and maintaining daily social interactions with others (e.g., social media, text messages, and emails; Magnifico, 2010). As such, individuals who have impairments in written expression are at risk for poorer academic, occupational, and social outcomes (Delano, 2007). Past research has shown, though, that strong academic performance in primary and secondary school can empower students with ASD to attend post-secondary institutions and obtain meaningful employment (Hendricks & Wehman, 2009; Schaefer-Whitby & Richmond-Mancil, 2009). As a result, there is great need for effective methods to teach writing to children with ASD. However, before appropriate instructional methods can be developed, a more complete understanding of written expression ability in children and adolescents with ASD is needed.

Writing Ability in Individuals with ASD

To date, research on writing ability in children with ASD has mostly focused on children's performance on standardized assessments, such as the Wechsler Individual Achievement Test, Second Edition (WIAT-II; Wechsler, 2001) and the Woodcock Johnson Tests of Achievement (WJ-III; Woodcock, McGrew, & Mather, 2001). When using these assessments, several researchers have reported a discrepancy in ability profile where children's standardized writing scores are significantly lower than their full-scale IQ, indicating a learning disability in written

expression (e.g., Assouline, Foley-Nicpon, & Dockery, 2012; Griswold et al., 2002; Mayes & Calhoun, 2003, 2008). Others have found that the standardized writing scores of children with ASD are also lower than those of their neurotypical (NT) peers (Zajic et al., 2016). Although these studies have provided valuable information about the overall writing skills of children with ASD, Brown, Johnson, Smyth, & Oram-Cardy (2014) point out that they often fail to describe the writing ability of individuals with ASD in detail or depict *how* the texts constructed by individuals with ASD align or deviate for NT children.

In attempts to address this problem, a handful of researchers have used detailed linguistic analysis to comprehensively characterize the writing ability of individuals on the spectrum. In one of the first descriptive studies of writing, Brown and Klein (2011) examined the ability of adults with and without ASD to write personal narrative and expository essays. When examining these texts, Brown and Klein found that adults with ASD wrote narrative and expository texts that were lower in quality than NT adults, which included how coherent, structured, and elaborative texts were. Additionally, the personal narratives written by adults with ASD were shorter, or less productive than those of their counterparts. However, the majority of word and sentence-level features of writing—lexical complexity, syntactic complexity, and frequency of spelling and grammar errors—were relative strengths for adults with ASD as no significant difficulties were present in either writing task.

More recently, Brown (2013) explored the writing abilities of children and adolescents with ASD. In her unpublished dissertation, Brown found that the fictional narratives of 8- to 17-year-old high-functioning children and adolescents with ASD were no different than those of their language-matched peers with regards to productivity, syntactic complexity, use of writing conventions (e.g., frequency of grammar, spelling, punctuation, and capitalization errors), and

overall narrative clarity. In fact, children with ASD used more unique words than their NT peers, resulting in the construction of more lexically diverse narratives. However, the fictional narratives of children with ASD were rated lower in narrative form (i.e., narrative organization, character development, reference to mental states) compared to NT children. In particular, their narratives were less well structured, had less developed characters, and were less likely to explain the meaning behind characters' actions and intentions. Using the same sample of children, Brown et al. (2014) compared the persuasive writing skills of high-functioning children and adolescents with ASD to their NT peers. This study found that children on the spectrum wrote shorter persuasive essays that were less syntactically complex and were rated lower on overall quality compared to NT children. Similar to Brown (2013), children with ASD also used more rare words (e.g., frequency rating of greater than 3000) and unique words when writing than their peers. Moreover, children with and without ASD did not differ in their use of writing conventions or how cohesive their persuasive essays were.

Finally, Dockrell, Ricketts, Charman, & Lindsay (2014) assessed the personal narrative writing of 6- to- 12-year-old children with ASD and children with language impairments (LI) for text productivity, grammar (e.g., correct number of word sequences), and quality. Dockrell et al. (2014) found that children with ASD wrote longer personal narratives that had more correct grammar than children with LI. However, children with ASD did not differ from children with LI on a holistic rating of writing quality. Dockrell and colleagues then compared the writing ability of children with ASD who had language impairments to children with LI, finding that previous differences in writing productivity and grammatical accuracy disappeared. Although this study did not include a control group of NT children, these findings help to highlight the importance of language ability on written expression in children with ASD.

Taken together, the most consistent finding across these writing studies is that individuals with ASD seem to have challenges with text quality, regardless of the specific rubric used. Text quality was not only a problematic aspect of writing for children and adolescents with ASD (Brown, 2013; Brown et al., 2014), but adults as well (Brown & Klein, 2011). In contrast, whether or not individuals with ASD have difficulty with productivity, as well as word and sentence level features of writing— lexical diversity, syntactic complexity, grammar and writing convention errors— seems to vary from study to study.

Considering Writing Genre: Narrative Versus Expository

It is important to point out that while there are similarities across studies, each study focused on a different style, or genre of writing, including fictional narrative, personal narrative, expository, and persuasive writing. Genre is a crucial factor to consider when examining written expression skills because each writing style serves a different communicative purpose and requires a different type of organizational structure and content. For instance, narratives give the writer the opportunity to reflect upon, reason about, or describe actions and experiences that are real or fictional (Mckeough et al., 2006). Narrative writing can take several different forms including fictional narratives, which are stories invented by imagination, and personal narratives, which are true stories that recount personal experiences. In terms of structure and content, there are a number of common underlying features of narrative writing, i.e., introduction of the settings and characters, a plot or action sequence, discussion of character's intentions/emotions, and a conclusion or lesson (Stein & Glen, 1979).

In contrast, expository writing is used to explain, describe, or inform the reader about a topic, and thus is the primary means in which children demonstrate acquired knowledge in school (Moffett, 1988). Consequently, it is also a major focus of classroom writing instruction

(Graham, 2006). Additionally, children often use expository discourse outside of school to discuss a range of topics, such as sports, relationships, interests, and to analyze events (Scott, 2010). Although there are many subgenres of expository writing (e.g., description/informational, comparison, cause and effect), there are several universal features. In particular, expository texts are hierarchically and locally organized by a central proposition or thesis, which is followed up with qualifications, elaborations, and examples (Scott, 2010). Persuasive writing is quite similar to expository writing in structure. However, unlike expository writing, persuasive writing contains the biases and the opinions of the writer with the goal to convince others to agree with the writer's point of view (Nippold, Ward-Lonergan, & Fanning, 2005). In order to write either style of essay, children need to have their own ideas and must be able to explain these ideas in order to create a coherent piece of discourse with a thematic structure. Past research has found that children's knowledge of the topic at hand also greatly impacts their essay writing (McCutchen, 1986). While understanding persuasive writing is important, for the purpose of the present study, further discussion of writing will be focused on narrative and expository writing, as these two genres are the most commonly used in elementary classrooms (Berman, 2008).

Development and Differentiation of Narrative and Expository Writing

Given the differences in each genre's purpose, structure, and content, children's ability to write in a particular style follows a unique developmental progression. Around the age of 9, NT children show the ability to differentiate between genres when writing narrative and expository texts (Berman & Nir-Sagiv, 2004, 2007). Berman and Nir-Sagiv (2007) found that NT children achieve command of global level discourse earlier in narrative texts compared to expository texts, and that it's not until adolescence that children master the organization of expository writing. This pattern is not surprising as most children begin to tell, and then read narratives,

before they begin to write narratives. More specifically, NT children will begin telling narratives orally during preschool, reaching an adult-like grasp of story structure around 9 or 10 years old (Berman & Slobin, 1994; Karmiloff-Smith, 1983; Peterson & McCabe, 1983). Once children begin to read around the age of 6, they are further exposed to narrative organization and content (Chall, 1983). Therefore, by the time children begin writing, they should have a fairly solid grasp of narrative form.

Expository organization may lag behind narrative organization for several reasons. First, expository writing depends on extensive schooling and exposure to written language, which is typically restricted to academic settings and school-based, literacy-related activities (Graesser & Goodman, 1985). Second, unlike narrative texts, which do not need to be particularly stimulating in content or complex in episodic structure, expository writing requires the author to come up with their own ideas and be motivated enough to explain these ideas in order to create a coherent text (Berman & Nir-Sagiv, 2007).

Part of what distinguishes narrative form from expository is the use of evaluative devices. Evaluative devices are strategies the narrator employs to maintain audience involvement in the story (Labov & Waletzky, 1967), such as descriptions of a character's mental/affective states, causal explanations, dialogue, sound effects, and subjective remarks. Evaluation helps the narrator convey the gist of the story by providing interpretations of the events and characters and establishing the relational significance of events (e.g., Bamberg & Damrad-Frye, 1991; Labov & Waletzky, 1967; Peterson & McCabe, 1983; Reilly, 1992). With age, the diversity and frequency of evaluative devices increases in spoken (e.g., Peterson & McCabe, 1983; Bamberg & Damrad-Frye, 1991), and written contexts (Drijbooms, Groen, & Verhoeven, 2017). Given the nature of these devices, children do not employ them as frequently in expository texts.

When considering vocabulary and syntax, though, children at all ages typically use more advanced vocabulary and complex syntax in expository writing than in narrative writing (Berman & Nir-Sagiv, 2004, 2007). While personal narratives are typically produced in the context of informal, everyday conversations, expository texts are encountered mainly in the classroom or during school-related activities. As a result, they are associated with the "literate lexicon" (Ravid, 2004). Compared to the narratives of NT children, expository texts have been reported to have more abstract vocabulary, greater clausal density, longer clauses (Malvern, Richards, Chipere, & Duran, 2004), more complex noun phrases (Ravid & Berman, 2010), more nominalized forms (Schleppegrell, 2004), more relative and adverbial clauses (Scott & Windsor, 2000; Scott, 2004), and more passive voice constructions (Jisa, Reilly, Verhoeven, Baruch, & Rosado, 2002). However, as NT children move from early elementary school through high school, the productivity, semantic diversity, and syntactic complexity of both styles of writing continues to improve (Berman, 2008).

Narrative and Expository Writing in Individuals with ASD

Although past research has shown that the writing ability of children with ASD can improve from early childhood to adolescence, especially when it comes to writing quality (Brown et al., 2014; Dockrell et al., 2014), it is not well understood how children with ASD may perform when comparing different writing styles (e.g., narrative vs. expository writing). There is evidence to suggest that expository writing may actually be easier than narrative writing for individuals with ASD (Brown & Klein, 2011). Although Brown and Klein (2011) did not directly compare personal narrative writing and expository writing skills in adults with and without ASD, upon closer examination, several interesting genre differences should be noted. In particular, adults with ASD wrote less productive personal narrative texts, but not expository texts, compared to

their NT counterparts. Moreover, adults with ASD scored lower than NT adults on five of the quality-related subscales (structure, balance, context, quality, and global coherence) when writing personal narratives. Conversely, when writing expository essays, adults with ASD only scored lower on two quality-related variables: global coherence and percentage of locally coherent sentences. These findings suggest that personal narrative writing may have been more challenging than expository writing for adults with ASD.

Although research has not examined this genre distinction in children, studies on oral discourse and reading research indicate that this pattern of writing could also hold true for children with ASD. Generally speaking, difficulties with oral discourse are widespread among children with ASD, including problems initiating and maintaining conversational interactions (Capps, Kehres, & Sigman, 1998; Tager-Flusberg & Anderson, 1991), and a lack of motivation or ability to share experiences through narration (Bruner & Feldman, 1993; Loveland, McEvoy, & Tunali, 1990; Loveland & Tunali, 1993). Evidence suggests that of these two types of discourse, narration may be especially problematic for children with ASD (Kroenke, 2015; Wagner, Nettelbaldt, Sahlén, & Niholm, 2000). For example, Kroenke (2015) compared the conversational and narrative language samples of 3 six-year-old children with ASD to age-matched NT peers in the Systematic Analysis of Language Transcripts (SALT; Miller & Iglesias, 2018) database. While children with ASD had a more difficult time than NT children in both discourse conditions, children with ASD produced more fluent utterances when having a conversation about a particular topic than narrating from a picture book (Kroenke, 2015). Similarly, in the context of reading, research has suggested that reading expository texts is less challenging (Gatley, 2008) and preferable (Randi, Newman, & Grigorenko, 2010) over reading

narrative texts for children with ASD. Randi et al. (2010) suggests that this may due to the greater social reasoning and pragmatic language demands put forth by narratives.

Finally, when considering genre differences, it is also important to bear in mind the specific type of narrative task— fictional versus personal. In Happe's (1991) assessment of the autobiographical writings of three individuals with Asperger's syndrome, she noted that, "surely the self-expression of writing, *especially writing about oneself*, must put the greatest test to those social, imaginative, and communicative skills thought to be crucially impaired in autism" (p. 207). Indeed, research on *oral* narration has found that children with ASD tell less syntactically diverse, thematically integrated, and elaborative personal narratives compared to their own oral fictional narratives (Losh & Capps, 2003). Moreover, Losh and Capps (2003) found that children with ASD utilized fewer types of evaluative devices than NT children when telling personal narratives, but used a comparable range of devices when telling fictional narratives. Together these findings suggest that personal narrative writing may prove to be one of most challenging writing genres for children with ASD. However, more research is needed to better understand the ability of *children and adolescents* with ASD to write narrative texts, and how it develops alongside expository text construction.

Nature of Writing Challenges in Children with ASD

In addition to understanding *how* writing development may differ, it is also crucial to understand *why* written expression may be more challenging for individuals with ASD.

According to Berninger's interdisciplinary model of writing development, writing (i.e., language by hand) is one of our four language systems, that interacts and develops alongside our other language systems—(1) language by mouth (speaking), (2) language by ear (listening), (3) language by eye (reading; Berninger, 2015; Berninger & Abbott, 2010; Berninger & Neido,

2014; see James, Jao, & Berninger, 2016, for a review). Under this framework, it is believed that "language develops as it interacts with its 'end organs,'... The end organs include (a) the sensory systems that receive incoming information from the environment, such as ears while listening to aural language and eyes while reading written language; and (b) the motor systems that operate upon the physical and social environment during literacy learning, such as mouth while producing oral language to express ideas and hand while producing written language to express ideas" (Berninger & Abbott, 2011, p. 635). Moreover, each of these language systems emerge in "overlapping, cascading waves" that develop in an interacting manner in early and middle childhood (Berninger, 2000).

However, within this conceptual model, not only does the writing system interact with our other language systems throughout development (Berninger & Abbott, 2010), but the writing system also interacts with cognitive, sensory/motor, social emotional, and attention/executive function systems in the developing brain (Berninger, 2015). Children with ASD often present with delays or deviations on a number of skills within these systems that can influence the writing process, including (1) oral language (i.e., speaking and listening; Boucher, 2012), (2) fine-motor skills (Mayes & Calhoun, 2003), (3) social cognition (Tager-Flusberg, 2007), and (4) executive functioning (EF; Kenworthy, Yerys, Anthony, & Wallace, 2008). Developmental differences in these systems may not only cause their writing process to differ from NT children, but the substantial individual differences within these domains may lead to the reported heterogeneity in writing performance among children with ASD (Brown, 2013; Brown & Klein, 2011; Dockrell et al., 2014; Happé, 1991; Mayes & Calhoun, 2003).

Using Berninger's model of the writing brain as our theoretical framework, the text that follows explores, in detail, how each of these four mechanisms (i.e., oral language, fine-motor

skills, social cognition, and executive functioning) may be contributing to writing development generally, as well as writing impairments in children with ASD.

Oral Language Ability and Writing Development.

As mentioned above, there is a close dynamic, developmental relation between written and oral language (speaking and listening) abilities in childhood (Berninger & Abbott, 2010). More specifically, writing ability has been linked to general oral language ability (Berninger & Abbott, 2010), as well as the various levels of our language systems, including phonology (Berninger, Abbott, Whitaker, Sylvester, & Nolen, 1995, Mackie, Dockrell, & Lindsay, 2013), semantics (Baker, Gersten & Graham, 2003), receptive grammar (Mackie et al. 2013), narration (Cragg & Nation, 2006), and general pragmatics (Troia, 2011). These different aspects of oral language all contribute to better writing in some fashion, whether it is at the word-level, sentence-level, or text level (Graham, Harris, & Chorsempa, 2002, Mackie et al., 2013; Shanahan, 2006; Troia, 2011). For instance, Graham, Harris, and Chorsempa (2002) believe that children's writing productivity draws on their transcription skills (handwriting and spelling), as well as vocabulary ability. With regards to grammatical complexity, it has been suggested that the ability to write complex sentences is supported by children's knowledge of morphology and syntax (Mackie et al., 2013; Shanahan, 2006). Others have postulated that text quality is bolstered by dimensions of both structural and pragmatic language ability (Troia, 2011).

Therefore, when children show weaknesses in oral language ability, it can place constraints on aspects of written language production. Consequently, the communication deficits, considered to be a hallmark feature of ASD, are likely to serve as a barrier to the acquisition of written expression for individuals on the spectrum. In fact, studies have shown that the general oral language ability of children with ASD is predictive of the grammatical

accuracy (Dockrell et al., 2014) and quality of writing (Brown, 2013; Brown et al., 2014; Dockrell et al., 2014).

This research, though, has been limited to the narrative writing ability of children and adolescents with ASD. Given the nature of the genre, expository writing arguably places greater cognitive and linguistic demands on the writer (Scott & Windsor, 2000). In turn, language ability may play an even stronger role in this style of writing for children with ASD. Evidence to support this comes from research with children with language learning disabilities (LLD). For example, when comparing spoken and written summaries of narrative and expository discourse, Scott and Windsor (2000) found that the expository summaries of children with LLD were shorter, less fluent and complex, and more error prone than their narrative summaries. With this in mind, it important to examine the impact of oral language on expository writing in particular among children with ASD, as those with language impairments may show a similar writing profile.

Fine-Motor Skills and Writing Development.

In addition to processing linguistic demands, the production of written texts requires children to attend to the motor demands of handwriting. Handwriting is the process of forming letters or symbols (Ziviani & Wallen, 2006) that allows us to physically express our ideas. As children gain experience with writing, their ability to write letters or words becomes more automatic. With greater automaticity in writing comes a reduction in motor demands that previously interfered with higher-order cognitive processes related to composition (Graham & Weintraub, 1996; Jones & Christensen, 1999). For instance, handwriting skills, particularly handwriting fluency (i.e., the amount of text that can be copied correctly in a period of time) improves with age and direct instruction (Graham, Berninger, Weintraub, & Schafer, 1998;

Hamstra-Bletz & Blote, 1990). However, without automaticity, the struggle between motor and cognitive processes can disrupt the flow of planning ideas and their translation into writing, resulting in less complex and coherent texts (Graham & Wientraub, 1996). As a result, individual differences in handwriting skills, especially fluency, predict how much and how well children write (Graham, Berninger, Abbott, Abbott, & Whitaker, 1997; Jones & Christensen, 1999).

Children with ASD are more likely than the general population to have fine motor difficulties that may inhibit their ability to acquire and produce skilled motor tasks, including handwriting (Fuentes, Mostofsky, & Bastian, 2009). Furthermore, children with ASD often have a high prevalence of dyspraxia, or difficulties with organization, planning, and execution of movement that affect coordination, fluency, and speed of motor activities (Gibbs, Appleton, & Appleton, 2007; Ming, Brimacombe, &, Wagner, 2007; Dowell, Mahone, & Mostofsky, 2009). Not surprisingly, as a result of these impairments, the handwriting of children with ASD is often diminished in overall fluency and legibility, and compromised in letter formation (see Kushki, Chau, & Anagnostou, 2011, for a review). It is believed that these impairments in handwriting may present a unique barrier to writing for children with ASD. To the authors' knowledge, only one study has examined the direct relation between handwriting and written expression in children with ASD. In this study, Dockrell et al. (2014) found that handwriting fluency, or speed, predicted writing productivity and grammaticality in children with ASD. Although this provides important evidence for the relation between handwriting and writing in children with ASD, more research is needed to examine how other components of handwriting (e.g., legibility) may impact text production.

Theory of Mind and Writing Development.

Social cognition is also believed to play an important role in the writing process (Berninger, 2015). One particular aspect of this is theory of mind (ToM). ToM refers to the ability to comprehend the mental states (e.g., perceptions, beliefs, desires, intentions, thoughts, emotions, pretenses) of oneself and others, and to understand that others' mental states can differ from one's own (Miller, 2006; Nader-Grosbois & Day, 2011). Delays or impairments in the development of this cognitive ability are pervasive in children with ASD. In fact, one of the most prevalent theories used to explain communicative and linguistic difficulties in individuals with ASD is a deficit in ToM ability (e.g., Baron-Cohen, Leslie, & Frith, 1985; Frith, 2001; Tager-Flusberg, 2007).

ToM may influence the writing process in a number of ways. First, good ToM skills may help children to more easily write about their own thoughts and feelings, and those of their characters (Tager-Flusberg & Sullivan, 1995). Second, being able to "read" the minds of others may make it easier to take the perspective of the reader and understand what the reader needs to know for the text to make sense. In turn, if children have poorer ToM skills, there texts may have less appropriate background information or content, as well as a lack of explicit, causal connections that lead the reader through the text (Colle et al., 2008; Loveland et al., 1990). Indeed, several studies have linked ToM to writing ability in adults with ASD. Brown and Klein (2011) found higher-order ToM to be related to the length and overall quality of the expository and narrative texts constructed by adults with ASD. Barnes et al. (2009) found that adults with ASD used fewer mental terms than their NT peers, indicating that there may be limited ToM content in the texts of individuals with ASD. More research is needed to understand if this finding holds true for children with ASD.

Executive Functioning and Writing Development.

According to Berninger, of the four language modes through which language is accessed or expressed, writing requires the greatest involvement of our executive functions (Berninger, 2015; Berninger, Abbott, Cook, & Nagy, 2017). EF is an umbrella term that refers to cognitive skills that serve independent, purposive, goal-direct, and self-serving behaviors (e.g., working memory, planning, cognitive flexibility, inhibition). In order to write well, children need to recruit lower-level executive functions (i.e., focus attention, switch attention, sustain attention, and self-monitor), as well as high-level executive functions for planning (i.e., setting goals and making plans to reach them), translating cognitions into language, reviewing, and revising during text construction (Berninger et al., 2014). As a result, immature and struggling writers will often use an approach that reduces the role of EF when writing. More specifically, poor or novice writers will often convert the writing task into simply providing all of their knowledge about the topic, instead of spending time determining a suitable approach to plan, structure, and revise their writing (Graham, Harris, & Olinghouse, 2007). Past research has found that differences in EF, specifically initiation (e.g., planning, working memory) and set-shifting (e.g., cognitive flexibility, self-monitoring), often separates good writers from poor writers (Hooper, Swartz, Wakely, de Kruif, & Montgomery, 2002).

Children with ASD are among those who show signs of executive dysfunction in both lab-based (Kenworthy et al., 2008) and everyday situations (van den Bergh, Scheeren, Beeger, Koot, & Geurts, 2014). While the specific domain of EF that is impaired varies from child to child, research has noted that cognitive flexibility and planning are the most consistently challenging for individuals on the spectrum (Kenworthy et al., 2008). In a recent study, Zajic et al. (2016) examined the specific role of attention disturbance on the writing ability of children

with ASD with low levels of ADHD symptoms, (HFASD-L), children with ASD with high levels of ADHD symptoms (HFASD-H), and NT children. Zajic and colleagues found that children with HFASD-H had lower overall standardized writing scores than NT children, whereas the writing scores of HFASD-L children did not differ from NT children. Moreover, Dockrell et al. (2014) has found that children with ASD with better verbal working memory (WM) have a better grasp on foundational writing skills, such as handwriting fluency and spelling. Nevertheless, further research is needed to understand how EF skills besides attention and working memory may relate to text production in children with ASD across writing genres. To the author's knowledge, studies have yet to compare cognitive flexibility and planning ability to written expression children with ASD, despite these skills being crucial for the writing process and the most consistently challenging for children with ASD.

Overview of Present Study

Despite research indicating children with ASD have global writing deficits (e.g., Mayes & Calhoun, 2008), studies that have comprehensively characterized the writing ability of children with ASD, especially across genre, remain scarce. Therefore, the first objective of the present study was to examine the personal narrative and expository writing skills of children with and without ASD using fine-grained linguistic analysis. The personal narrative and expository texts of 8- to 14-year-old children with ASD were compared to those of their NT peers on a number of text variables, including productivity, syntactic complexity, lexical complexity, frequency of grammatical errors, use of writing conventions (e.g., punctuation, spelling, capitalization), use of evaluative devices, and overall quality. The second goal of this study was to gain a better understanding of the individual characteristics and mechanisms that may be contributing to differences in writing profiles between children with and without ASD. Using Berninger's

multi-level model of writing as our theoretical framework, we then examined the relations between writing performance and children's age, oral language ability, handwriting skills, ToM, and EF.

Our research questions and predictions were as follows:

1. What are the writing strengths and weaknesses of children with ASD in comparison to their NT peers?

   Hypothesis 1: It was expected that the writing quality of children with ASD would be lower than NT children, where children with ASD would produce texts that were less coherent, organized, and included less background information. It was also expected that children with ASD would use fewer evaluative devices than their NT peers. Given inconsistencies in past research (Brown et al., 2014; Brown & Klein, 2011), it was unclear whether children with ASD would differ from their peers with regards to productivity, syntactic complexity, lexical diversity, grammatical errors, and writing conventions.

2. Are there any differences in writing performance between text genres (personal narrative and expository) for children with and without ASD?

   Hypothesis 2: Due to inherent stylistic differences between text types, and previous findings (Berman & Nir-Sagiv, 2007), both groups of children were hypothesized to write expository texts that were more lexically and syntactically complex than their narrative texts. Moreover, we predicted that a greater number and range of evaluative devices would be included in personal narrative texts than expository texts, at least for NT children. Finally, when it came to writing quality, we expected to see greater differences

between children with and without ASD for personal narratives texts than expository texts.

3. What is the relation between writing ability and age?

   Hypothesis 3: Based on previous research (Berman, 2008), it was expected that for NT children writing ability would get better as children got older. More specifically, we expected the texts of older NT children to have more complex vocabulary and syntax, a greater frequency and range of evaluative devices, fewer grammar and writing convention errors, and higher quality ratings than texts written by younger NT children. Although past research has found age-related improvements in writing quality in children with ASD (Brown et al., 2014; Dockrell et al., 2014), given persistent difficulties with narrative and expository writing in adulthood (Brown & Klein, 2011), it was unclear whether these same writing skills would improve with age for children with ASD.

4. What is the relation between writing ability and various writing mechanisms (i.e., oral language ability, handwriting skills, ToM, and EF)?

   Hypothesis 4a: For both children with and without ASD, it was hypothesized that greater oral language ability would lead to better writing at the word, sentence, and text level, especially for expository texts.

   Hypothesis 4b: We predicted that overall children with ASD would have greater problems with handwriting compared to their NT peers. Nevertheless, we hypothesized that for both groups of children greater handwriting fluency and legibility would be related to better writing at the word and sentence level (i.e., productivity, lexical diversity, syntactic complexity, and spelling, punctuation, and capitalization errors).

Hypothesis 4c: Children with ASD were expected to score lower on ToM ability compared to their NT peers. In line with previous research (Brown & Klein, 2011), ToM ability was expected to predict writing ability, especially personal narrative writing quality, in children with and without ASD.

Hypothesis 4d: Given inconsistent findings in past research (Kenworthy et al., 2008), it was unclear the severity and scope of EF impairments that would be present within our ASD group. However, based on past research (Dockrell et al., 2014; Zajic et al., 2016), it was expected that both children with and without ASD who had better EF skills would construct better texts at the local and global level.

CHAPTER TWO

METHODS

Participants

A total of 58 children between 8 and 14 years of age participated in this study: 29 children with ASD (M_{age} = 10;09) and 29 NT children (M_{age} = 10;08). All children (1) had an overall IQ greater > 70, as established by the Weschler Abbreviated Scale of Intelligence (WASI-II; Weschler, 2011); (2) were fluent in English, as reported by parents; (3) and had no known sensory impairment (e.g., hearing or vision impairment), neurological disorder (e.g., epilepsy, hydrocephalus), or major psychiatric disorder (e.g., psychosis, schizophrenia). All parents were asked to complete a form reporting any previously diagnosed developmental, psychiatric, medical, or mental health condition(s), the age of diagnosis, and the provider of diagnosis (see Appendix A). Children were recruited from local school districts serving children with and without ASD, and children were also recruited from support groups for families of children with ASD. See Table 1 for additional participant demographics and characteristics.

All children with ASD had a clinical diagnosis previously established by medical evaluation with a pediatrician and/or a licensed clinical psychologist in accordance with the *Diagnostic and Statistical Manual of Mental Disorders-IV* (APA, 2000), and met the criteria for ASD as outlined by the Individuals with Disabilities Education Improvement Act (IDEA; 2004). Therefore, all children with ASD were previously identified by their school as having an ASD diagnosis and were receiving services for this diagnosis through their Individual Education Plan. This diagnosis

was further corroborated with two widely used diagnostic tools: the Childhood Autism Rating Scale, Second Edition (CARS-2; Schopler & Van Bourgondien, 2010), and the Social Responsiveness Scale, Second Edition (SRS-2; Constantino & Gruber, 2012).

The CARS-2 is a behavior rating-scale used to help identify children with autism and determine symptom severity based on experimenter observation and parent report. The CARS-2 has a high degree of internal consistency and good interrater reliability (Schopler & Van Bourgondien, 2010). The CARS-2 also has a strong association with the "gold standard" Autism Diagnostic Observation Schedule (ADOS). Only children with ASD were assessed using the CARS-2. Seventeen children with ASD had mild-to-moderate symptoms, and eleven children with ASD had severe symptoms.

The SRS-2 is a 65-item parent-report questionnaire (Constantino & Gruber, 2012) that assesses social awareness, motivation, anxiety/avoidance, the capacity for reciprocal social communication, and stereotypical behaviors or highly restricted interests, characteristic of ASD. The SRS-2 is able to differentiate individual subjects along a continuum of severity of social impairments. The SRS-2 is also highly related with gold standard diagnostic tools such as the ADOS and the Autism Diagnostic Interview, Revised (Bölte et al., 2011). All parents were asked to complete the SRS-2. Four children with ASD had a mild social impairment (60 - 65 T-score), seven children with ASD had a moderate social impairment (66 – 75 T-score), and ten children with ASD had a severe social impairment (76 or higher T-score). Despite continued efforts, eight parents of children with ASD did not fill out the SRS-2 questionnaire. However, no differences in chronological age, $t(27) = 1.70$, $p = .10$, CARS-2 scores, $t(27) = 1.54$, $p = .14$, FSIQ-2, $t(27) = .01$, $p = .99$, or CELF-5, $t(27) = .06$, $p = .99$, were found between children with and without SRS-2 scores. All NT children fell below the threshold for ASD symptoms (T-score

of 59 or lower), and their SRS-2 scores were significantly lower than the ASD group, $t(49) = 7.39$, $p = .0001$. See Table 1.

Table 1. Participant Demographic and Diagnostic Information

	Children with ASD	NT Children
Chronological Age	10;09 (2;00)	10;08 (1;07)
Male:Female	25:4	21:8
Racial/Ethnic Identity		
African American	10.7%	10.3%
Asian	3.6%	6.9%
Caucasian	60.7%	62.1%
Latino/Latina	14.3%	17.2%
Middle Eastern	0%	3.4%
Mixed	10.7%	0%
Average Family Income	$103,000 (113,900)	$85,428 (50,328)
Poverty Level	16%	0%
Lower Middle Class	33%	29%
Middle Middle Class	33%	57%
Upper Middle Class	18%	14%
Maternal Education		
Some/High School Graduate	16.7%	20%
Associate's degree	16.7%	0%
Bachelor's degree	61.1%	25%
Master's degree	0%	45%
Doctorate degree	5.6%	10%
Paternal Education		
Some/High School Graduate	17.7%	25%
Associate's degree	5.9%	0%
Bachelor's degree	47.1%	35%
Master's degree	11.8%	15%
Doctorate degree	17.6%	15%
Average Age of ASD Diagnosis	4;03 (1;09)	-------
CARS-2 T-score	51.09 (7.13)	-------
SRS-2 Total T-score***	72.44 (10.53)	47.76 (11.27)
Additional Diagnoses		
ADHD	5	3
Language Impairment	3	0
Mood Disorder	2	1
OCD	1	0

Note. Poverty Level = less than $18,500/yr.; Lower Middle Class = $18,500 – 47,700/yr.; Middle Middle Class = $47,700 -100,000/yr.; Upper Middle Class = $100,000 – 350,000/yr.; Upper Class = greater than $350,000. Income levels are based on household incomes for families of three (Pew Research Center, 2017). ***$p < .001$.

Materials

Intellectual Functioning.

Intellectual functioning was measured using the Wechsler Abbreviated Scale of Intelligence, Second Edition (WASI-II; Wechsler, 2011). The WASI-II is a condensed but reliable standardized measure of cognitive ability. The two-subtest version was administered, which is comprised of the Matrix Reasoning subtest (i.e., measure of non-verbal intelligence) and the Vocabulary subtest (i.e., measure of verbal intelligence). The WASI-II has good concurrent validity with the Wechsler Intelligence Scale for Children (WISC; Sattler, 2001). Full-scale IQ (FSIQ) was obtained to determine whether children had a possible intellectual disability (IQ < 70).

Language Ability.

Children were administered the Clinical Evaluation of Language Fundamentals, Fifth Edition (CELF-5; Wiig et al., 2013), which is a widely used standardized measure of language ability that assesses language across a variety of domains. The four subtests that comprise the Core Language Score were administered. This composite score was chosen because it provides a comprehensive structural language score. The CLS has good sensitivity and specificity at identifying children with a language disorder (standard score < 85; Wiig et al., 2013).

Handwriting and Keyboarding Fluency.

Children's handwriting and keyboarding was assessed via a copying task developed by DeCoste (2005). In both the handwriting and keyboarding conditions, children completed three brief tasks: (1) writing the alphabet, (2) copying a sentence containing all the letters of the alphabet (e.g., "The quick brown fox jumped over the lazy dogs.") and (3) writing a sentence from dictation (e.g., "Before I start to read, I turn on the light."). Children were asked to either

write the alphabet, copy the sentence, or write the sentence from dictation as many times as possible in 1 minute. In the handwriting condition, children completed these tasks on 1-inch lined paper. In the keyboarding condition, children completed these tasks in Microsoft Word with the spelling and grammar check turned off. In order to reduce the chance for memorization of the near-point and dictation tasks, handwriting and keyboarding assessments were administered during different sessions.

To measure fluency, the total number of letters written or typed per minute was divided by 5 to obtain a gross word per minute rate. In addition to obtaining a total fluency score, errors and handwriting legibility were calculated. In the handwriting condition, errors included reversals, omissions, and additions. In the keyboarding condition, errors included omissions and additions. With regards to handwriting legibility, experimenters identified the percentage of letters out of the total letters that were legible in each task. Children received overall fluency scores, error scores, and a legibility score (handwriting condition only) by averaging across the alphabet, copying, and dictation tasks.

Theory of Mind.

ToM was measured using a battery of measures that captured the various facets of ToM ability. The Unexpected Contents Task (Perner, Frith, Leslie, & Leekam, 1989) was used to assess first-order false belief (e.g. "John thinks…"). Children were shown a crayon box, and then asked by the experimenter what they thought was in the box. It was then revealed to the child that the box actually contained an unexpected object, paper clips. The experimenter then asked the child, "What did you think was in the box before you opened it?" Finally, the experimenter asked, "Say your mom (or friend) came into the room, what would she (or he)

think is in this box?" Children received a score of pass or fail depending on whether they could correctly answer each question.

In order to assess second-order false belief (e.g., "John thinks that Mary thinks…"), the Birthday Puppy Story (Sullivan, Zaitchik, & Tager-Flusberg, 1994) was administered. The Birthday Puppy is a story about a mother who intentionally lies to her son about what she got him for his birthday to surprise him (i.e., she says she got him a toy, but she really got him a puppy). The story was read aloud by the experimenter and accompanied by an illustration of the scenes being depicted. Two-dimensional cardboard figures of the characters were used to act out the story on the illustration. Children were presented with three probe questions, two control questions, two test questions assessing ignorance and false-belief, and a justification question where children had to explain their response to the second-order false belief question. Children received a total score on this test that included their answers to all questions except the control questions (max score = 6).

Finally, the Strange Stories Test (Happé, 1994) was administered to assess higher-order, or advanced ToM. Based on the procedure used by White, Hill, Happé, & Frith (2009), eight scenarios that assess children's understanding of mental states were administered. The mental state stories measure the attribution of complex mental states underlying nonliteral utterances, such as sarcasm, double bluff, lies, white lies, and contrary emotions. Past research has shown that children and adults with ASD, even those with above average IQ, perform more poorly on this measure compared to NT children and adults (White et al., 2009). Children's answers were scored for correctness (0 - 2). Two experimenters double-coded 25% of these tests in order to establish good inter-rater reliability (.85).

Executive Functioning.

In order to capture a more complete picture of EF skills in children with ASD, EF was measured using parent-report– the Behavior Rating Inventory of Executive Functioning, Second Edition (BRIEF-2; Gioia et al., 2015), and direct experimental evaluations – the Wisconsin Card Sorting Task- 64 Card Version (WCST-64; Kongs, Thompson, Iverson, & Heaton, 2000) and the Tower of Hanoi (Welsch, 1991). The BRIEF-2 is an 86-item standardized parent questionnaire that taps into *everyday* behaviors and activities associated with executive functions. It yields an overall Global Executive Composite (GEC) score, as well as three indices scores: Behavior Regulation Index (i.e., inhibition, self-monitoring), Emotion Regulation Index (i.e., cognitive shifting, emotional control), and Cognitive Regulation Index (i.e., initiating behaviors, working memory, planning/organization, organization of materials, and task monitoring). Higher scores on each of these indices indicates greater executive dysfunction. The BRIEF has good internal consistency (.80 - .98), and test-retest reliability (.82; Gioia et al., 2015).

The WCST-64 is a widely-used measure of EF and was adapted from the original Wisconsin Card Sorting Test (Heaton et al., 1993). Although it does tap into a broad number of EF skills (e.g., working memory, problem-solving), it is primarily used to measure cognitive flexibility (Gioia & Isquith, 2004). It consists of four stimulus cards and 64 response cards. The stimulus cards differ in color, shape, and number, while the response cards combine these dimensions such that a given response card can match a given stimulus card on different dimensions. The four stimulus cards are placed in front of the child as targets. The child is then asked to match each response card to the stimulus card according to the current rule or matching principle (e.g., color). However, children must figure out the matching principle based solely on feedback from the experimenter indicating whether their match was correct or incorrect. Once a

child achieves 10 consecutive correct matches, the experimenter changes the matching principle. Although a number of different scores can be obtained for the WCST-64, the standardized perseverative errors score was used. Errors are classified as perseverative when the child continues with the previously correct matching principle despite negative feedback. This score is used the most frequently to estimate cognitive flexibility (e.g., Geurts, Verté, Oosterlaan, Roeyers, & Sergeant, 2004; Ozonoff & Jensen, 1999; Winsler, Abar, Feder, Schunn, & Rubio, 2007), with a higher score indicating better cognitive flexibility. The WCST-64 has good reliability and concurrent validity (Kongs et al., 2000).

The Tower of Hanoi (Welsch, 1991) task is a commonly used assessment of planning, or problem solving. For this assessment, a wooden apparatus was used that has three pegs spaced evenly apart. This is accompanied by three or four disks, depending on the problem. These disks vary in color and size. The end objective of the game is to move the disks from their starting point to the far-right peg, with the largest disk on the bottom and the smallest disk on top. However, participants are instructed that they want to complete this in the least number of moves possible and as fast as possible while keeping with the following rules: (1) only one disk at a time could be moved, (2) a larger disk cannot be placed on a smaller one, (3) the middle peg had to be used, and (4) the disks must be placed on a peg at all times. Children were first asked to demonstrate their understanding of the rules before continuing to the practice problems (i.e., two two-disk, three-move problems). Once it was clear that they understood the rules and successfully completed the practice problems, they moved to the test problems. Based on the procedure explained by Welsch (1991), children completed four three-disk problems and three four-disk problems that increased in difficulty. Before beginning each problem, children were read the following instructions: “Before moving any discs, make sure to take some time and plan

or think about the moves you want to make before moving any disks. Also make sure to follow the rules we went over." From the moment the experimenter finished reading the instructions, they started the timer. The experimenter then marked down the amount of time it took the child to make their first move, how many moves the child made before all of the disks were on the right peg, whether the child solved the problem successfully (i.e., didn't violated any of the rules), and the total time it took to complete. Children received several scores for the Tower of Hanoi task: (1) total number of problems solved successfully; (2) average number of moves (i.e., accuracy); (3) average amount of time to first move (i.e., planning time); and (4) average time per move in each trial (i.e., solution speed).

All EF measures have been used extensively with populations that exhibit difficulties with EF, such as children with ASD (Geurts et al., 2004; van den Bergh et al., 2014).

Writing Measures.

Each child was asked to compose two texts, one personal narrative and one expository essay, on the computer using a word processor with spelling and grammar check turned off. The following personal narrative prompt was read aloud by the experimenter and provided on paper to the child to use while writing: "Write a story about a time that you had a problem or fight with another person or other people. It could be with a friend, sibling, parent, teacher, or another relative. Take time to think about and plan your story before you begin, including all elements of a good story. Write as much as you can."

We chose the content of this personal narrative prompt (i.e., problem with another person) because past research has shown that children are better able to recall specific events in more detail if they are less routinized, or scripted (e.g., birthday party, going to the doctor, day at school). Non-scripted types of events tend to include more variations and are experienced less

often (Hudson & Shapiro, 1991; Peterson & McCabe, 1983). Specifically, Peterson and McCabe (1983) found that children are likely to tell their best personal narratives when asked to discuss injuries (e.g., breaking bone, getting in a fight with a sibling), which are events that are centered on a high point, include more variations, and are experienced less frequently. However, we wanted to avoid the specific issue of injury with children with ASD. Therefore, we adapted our prompt from one used by Berman and Nir-Sagiv (2007) with NT children and Brown and Klein (2011) with adults with ASD.

The following expository, or informational essay, prompt was read aloud by the experimenter and provided on paper to the child to use while writing: "Choose a topic that is interesting to you, and that you know something about. It can be a favorite object, place, or activity. Imagine you have been asked to write a report about that topic. Decide on what is most important about that topic and then write an essay including that information. Take time to think about and plan your essay before you begin, including all elements of a good essay. Write as much as you can." The wording of this prompt was adapted from Olinghouse, Graham, and Gillespie (2015). However, unlike Olinghouse et al. (2015), we had children choose a topic that was "interesting to them and they knew something about" instead of writing an informational or descriptive essay about outer space. We chose to leave the topic choice up to the child to minimize differences in children's declarative knowledge. Additionally, past research has shown that the more knowledge a child has about the writing topic the better the text produced (Graham, McKeown, Kiuhara, & Harris, 2012; Graham & Perin, 2007; Olinghouse et al., 2015). Another factor that can influence a student's writing is his/her interest in the topic, as students with greater interest in a topic are likely to be more engaged and persistent when writing (Hidi & McLaren, 1991). Children with ASD did not differ from NT children on the topic they chose to

write about, i.e., object, place, activity, χ^2 (3, N = 53) = 2.37, p = .50, Φ = .22. Twenty-nine percent of children wrote about an object, 9% wrote about a place, 51% wrote about an activity, and the remaining 16% wrote about a topic that didn't necessarily fall into any category. See Appendix E for additional examples of the topics children wrote about in their personal narrative and expository texts.

Children were asked to write for at least 15 minutes, but they could have more time if needed. If children finished before this time was up, the experimenter asked the child to try to work on their writing a little longer. However, many children refused to keep writing once they felt they were done. The average amount of time children spent writing was 10 minutes. While children were writing, the experimenter noted several observations, including: (1) whether the experimenter needed to redirect the child's attention to the task, (2) whether the experimenter needed to use neutral prompting to help the child persist on the task, and (3) whether the child needed help generating ideas to get started. Once children completed a given writing task, the experimenter asked the child, "What do you think are important things or elements to include when writing a good story/essay?". Children's responses were than broken down into one of four ratings: 1 = doesn't know, 2 = has some grasp of story/essay elements, 3 = has pretty good grasp of story/essay elements, and 4 = has a very good grasp of story/essay elements.

Writing Attitudes Survey.

Once children completed all writing measures, the experimenter administered the writing attitudes subtest from Graham, Berninger, & Abbott's (2012) Writing and Reading Attitude Measure, which included 12 writing items that asked questions such as "How do you feel when you write in school during free time?" or "How do you feel when you start to write a new paper?" The rating scale was adapted slightly from the original, which had Garfield faces that

ranged from very unhappy to happy. Given potential emotion recognition difficulties of children with ASD and the age of the children in the present study, a 4-point rating scale was added, ranging from "Really Dislike" to "Really Like". Children received a composite writing attitudes score. Several additional questions were added to the end of survey to gain a better understand of children's writing process: (1) "How much time do you spend planning, or thinking about, what to write before you start?'; (2) How often do you edit, or fix, what you wrote before turning it in?"; and (3) "What do you find to be the hardest or most challenging part of writing?" All questions were read to the child.

Parent Literacy and Technology Questionnaire.

All parents were asked to fill out a series of questions about their child's writing ability and their child's use of technology both at school and at home. See Table 2 for parent's responses to selected questions and Appendix B for the full questionnaire.

Table 2. Parent Responses on Writing and Technology Questionnaire

	Children with ASD	NT Children
Average Age When Child Started Writing	4;04 (1;02)	4;05 (0;07)
Best Description of Child's Writing Ability		
Partially formed sentences	13.4%	0%
One to two sentences	26.7%	0%
Three or more unrelated sentences	13.3%	0%
Three or more related/organized sentences	20.0%	16.7%
Two cohesive paragraphs	13.4%	0%
Three cohesive paragraphs	13.2%	83.3%
Frequency Child Practices Writing at Home		
Seldom to never	11.1%	0%
Monthly	11.1%	0%
Weekly	33.4%	57.2%
Daily	44.4%	42.8%
Frequency Child Needs Assistance with Writing		
Seldom to never	11.8%	42.9%
Monthly	11.7%	14.3%
Weekly	41.2%	14.2%
Daily	35.3%	28.6%
Ways You Assist Child with Writing		
Letter formation	11.1%	0%
Read letter(s)	0%	14.3%
Plan/organize writing	72.2%	94.0%
Edit/revise writing	50.0%	85.7%
Maintain attention	77.8%	57.1%
Child Received Writing Tutoring	58.8%	42.9%
Proficiency of Keyboarding Skills (1= not at all proficient; 4= very proficient)	3.00 (1.17)	2.43 (7.87)
Years of Keyboarding Experience	5;06 (3;01)	4;11 (3;06)
Use of Computer at Home to Complete Assignments		
Never	23.5%	14.0%
Once a month	11.8%	57.1%
1 to 2 days a week	23.5%	14.3%
3 or more days a week	41.2%	14.6%

Coding of Text Variables for Personal Narrative and Expository Essays

All written texts produced were first transcribed using Systematic Analysis of Language Transcripts (SALT; Miller & Iglesias, 2018). To ensure transcription reliability, twenty-five percent of all texts were double-transcribed by the first-author and a research assistant blind to diagnostic group. Good transcription reliability was obtained (i.e., 87%). The unit of segmentation chosen was the T-unit, which refers to any independent clause and any clauses dependent on (Hunt, 1965). Discrepancies between what constituted a T-unit was resolved through discussion between transcribers. All texts were then coded for a number of variables that assessed productivity, lexical complexity, syntactic complexity, frequency of grammar errors, frequency of writing conventions errors, use of evaluation, and overall quality.

SALT provided information on the total number of words, total T-units, number of different words, and mean length of the T-unit. Given the nature of scoring for the remaining writing variables, good inter-rater reliability between the first author and the research assistant was established using intra-class correlations (ICC) for the following text variables: number of complex t-units (Personal Narrative [PN] = .78; Expository [E] = .80), number of noun phrases (PN = .91; E = .88), number of grammar errors (PN= .96; E = .90), number of punctuation errors (PN =.85; E = .88), number of capitalization errors (PN = .97; E = .99), frequency of evaluation (PN = .98; E = .88), and quality-related variables, i.e., coherence (PN = .85; E= .87), structure (PN= .96 ; E= .80), and content (PN = .75; Expository = .87). According to Cicchetti (1994), ICCs less than .40 indicate poor reliability, ICCs between .40 - .59 indicate fair reliability, ICC's between .60 - .74 indicate good reliability, and ICCs greater than .75 indicate excellent reliability. In cases of disagreement between the two raters, the average score was used.

Productivity.

Children's productivity, or fluency was quantified in two ways: (1) by assessing the total number of words in a text, and (2) by assessing the total number of T-units in a text.

Lexical Complexity.

Three measures of lexical complexity were obtained: (1) lexical diversity, (2) frequency of big words, and (3) frequency of rare words. Lexical diversity was measured with the number of different words (NDW) per 50 words. NDW was determined out of the first 50 words to reduce issues that could arise when sampling from texts of various lengths. More specifically, if NDW was taken out of the total number of words in a text, children that wrote more may also have a higher lexical diversity score that is not entirely independent from text length. Frequency of big words reflects the total number of words with seven or more letters divided by the total number of words. Frequency of rare words was determined by counting the total number of words that are considered very rare according to the Corpus of Contemporary American English (i.e., words that had a frequency rating of greater than 3000) divided by the total number of words. The following text analyzer was used to identify rare words: https://www.wordandphrase.info/analyzeText.asp.

Syntactic Complexity.

Syntactic complexity was measured using three variables: (1) mean length of t-unit (MLTU), (2) frequency of complex t-units, and (3) the frequency of nominal phrases. MLTU was defined as the mean number of words per T-unit and provides a measure of overall sentence length. MLTU specifies syntactic complexity at the phrasal level, clausal level, and level of argument structure (Scott & Windsor, 2000). The frequency of complex t-units was defined as the number of complex clauses per T-unit. Complex T-units included a T-unit containing a main

clause and one or more of the following: coordinating clauses, adverbial clauses, verb complements, and relative clauses. Coordinating clauses specifically referred to clauses where the co-referential subject in the coordinated clause was deleted (i.e., "My brother and I found a way out of the maze *and ran to the pumpkin patch*."). The last component of syntactic complexity that was assessed was the average length, or complexity of children's noun phrases. Noun phrases included the subject or object noun and all the words that modify it, and excluded all pronouns (Scott & Balthazar, 2013). The average length of a noun was determined by dividing the total number of words that were part of a noun phrase within the text sample by the total number of individual noun phrases.

Grammatical Errors.

Frequency of grammatical errors was assessed using Scott and Windsor's (2000) grammar error coding scheme. Grammatical errors were considered any error that rendered a t-unit ungrammatical, and included the following: omitted obligatory tense markers, missing grammatical morphemes (e.g., articles), wrong forms of verbs, pronoun number or case errors, omission of obligatory arguments, difficulties with main and subordinate clause relationships, and utterance level-errors (e.g., word order errors). The total number of errors was divided by the total number of T-units to determine the error ratio.

Writing Conventions.

Children's understanding of writing conventions was calculated by measuring the frequency of punctuation, spelling, and capitalization errors that were present in children's writing. The frequency of punctuation, spelling, and capitalization errors were calculated by counting the total number of each respective error and dividing by the total number of T-units.

Evaluation.

Texts were also coded for children's use of *evaluation*— a hallmark feature of narrative discourse (e.g., Bamberg & Damrad-Frye, 1991; Labov, 1972; Peterson & McCabe, 1983). We used the coding scheme described by Losh and Capps (2003). The coding scheme included the following seven categories of evaluative devices: (1) emotive/cognitive states and behaviors, (2) causality, (3) negatives, (4) hedges, (5) character speech/onomatopoeia/sound effects, (6) intensifiers, and (7) subjective remarks. See Appendix C for more details regarding the coding of each category. Children received two scores for evaluation: the first score indicated the frequency of evaluative devices used out of the total number of T-units, and the second score indicated the diversity, or range, of evaluative devices employed out of 7.

Quality.

Similar to past writing research (e.g., Berman, 2008; Brown & Klein, 2011; Moskal, 2000; Scott, 2009), coding rubrics were used to evaluate the two different types of texts for several aspects of writing quality: coherence, structure, and content. These coding schemas are based on those used by Berman and Nir-Sagiv (2007), Brown and Klein (2014), and Brown (2013). All three quality-related variables were coded on a 5-point scale from 0 to 4, 0 being the least proficient and 4 being the most proficient. When coding for *coherence*, the rating scale examined the degree to which children's ideas were connected, topic changes were smooth, and the writing was understandable to the reader (Brown et al., 2014). The coding rubric used to score coherence was the same for both the personal narrative and expository essay.

For *structure* of the text, we were looking for the degree to which essential structural or organizational elements existed in each text type. In contrast to coherence though, the way structure was scored differed for narrative and expository writing, as the requirements for

appropriate structure vary as a function of genre. When assessing children's personal narrative writing, we were looking for how well children included typical narrative structure (i.e., initiating event, problem/conflict, plans, resolution, ending). In contrast, the coding rubric for expository texts assessed the degree to which children included an introduction to the topic, supporting details about a topic, and a conclusion. At the most proficient level, children's text should be starting to resemble a multi-paragraph essay structure.

The coding rubric for *content* assessed the degree to which an appropriate amount of background information was provided. Like structure, separate rubrics were used for personal narratives and expository essays. The rubric used for personal narrative writing, assessed children's inclusion of details about their stories, such as information about the setting, the characters (e.g., thoughts/feelings), and the story actions. For expository writing, the rubric assessed children's description or expansion of ideas about the main topic. In other words, how well developed was their discussion of the subordinate categories or supporting details in their essays. See Appendix D for detailed descriptions of the holistic ratings.

Creation of Writing Composites

Given the large number of text variables described above, we sought to create composite scores to reduce the experiment-wise risk of false rejections of the null hypothesis. Composites scores were created by grouping the variables that were conceptually similar, including a productivity composite, syntactic complexity composite, writing conventions composite, and quality composite. The decision to form these composites was supported by the high inter-item reliabilities of each composite. Although we planned to form a composite for lexical complexity, inter-item reliability was low (Narrative α = .33; Expository α = .56) between lexical diversity, the frequency of big words, and the frequency of rare words. Therefore, these variables were

analyzed separately. Several other textual features were also analyzed individually in subsequent analyses, including frequency of grammatical errors and evaluation. See Table 3.

Procedure

Prior to the start of the study, approval was obtained from the Institutional Review Board at the host university. Informed consent was also obtained from children's parents, and all children provided verbal assent before testing began. Each child was tested individually in a quiet room. Children recruited through schools were tested in a quiet area provided by the school. Children recruited through support groups or our participant database were tested in their homes, our research lab, or at a local public library. Testing took place over 2 - 4 sessions depending on the needs of the child and the requests of the parents/schools.

Analytic Plan

A small number of students with ASD were not able to produce written texts. Therefore, differences between writers and non-writers were examined first. This was followed by a comparison of demographic and matching characteristics in our final sample of children with and without ASD. Subsequently, mixed-model analysis of co-variance (ANCOVA) was used to examine the personal narrative and expository writing ability of children with ASD and NT children, running separate analyses for each writing variable (e.g., productivity, quality). See below for additional information regarding the covariates. Additional analyses were run to examine children's behavioral and attitudinal differences in regards to writing. Finally, Pearson correlations were used to examine the relation between writing performance and the following individual characteristics: age, FSIQ, language ability, handwriting and keyboarding ability, ToM, and EF. Finally, linear multiple regression analyses were conducted in order to determine

which factors (i.e., diagnostic group, age, oral language ability, and ToM) uniquely predicted the quality of personal narrative and expository writing.

Table 3. Description of Text Variables

Composite	Variable	Definition	Cronbach's Alpha
Productivity	Total words	Total number of words in the text	PN α = .98 EE α = .94
	Total T-units	Total number of t-units	
Lexical Complexity	Lexical Diversity	A count of the total number of different words (NDW) out of 50 words	PN α = .56 EE α = .33
	Frequency of large words	The number of words with seven or more letters divided by the total number of words	
	Frequency of rare words	The number of words that are considered very rare, i.e., words that had a frequency rating of greater than 3000 divided by the total number of words	
Syntactic Complexity	Mean length of t-unit (MLTU)	The mean number of words per T-unit	PN α = .76 EE α = .70
	Complex T-units	The frequency of T-units that included complex syntax	
	Average length of nominal phrases	The number of total words in noun phrases divided by total noun phrases	
Writing Conventions	Frequency of punctuation errors	The total number of punctuation errors/number of T-units	PN α = .83 EE α = .70
	Frequency of spelling errors	The total number of spelling errors/number of T-units	
	Frequency of capitalization errors	The total number of capitalization errors/ number of T-units	
Grammatical Errors	Frequency of grammar errors	The total number grammar errors/number of T-units	-----
Evaluation	Frequency of evaluation	Total number of evaluative devices/number of T-units	-----
	Diversity of evaluation	Total different types of evaluative devices employed (max.= 7)	-----
Quality (score 0-4)	Coherence	The degree to which ideas were connected, topic changes were smooth, and the text was understandable	PN α = .94 EE α = .91
	Structure	The degree to which essential structural and organization elements exist in text	
	Content	The degree to which the student provides background information essential for the text type	

CHAPTER THREE

RESULTS

Writers Vs. Non-writers: Determining Final Sample

Five of the 29 children with ASD failed to produce written texts independently. In contrast, all 29 NT children wrote in response to the writing prompt. The non-writers with ASD either refused to write or would only dictate to the experimenter what they would like to say. Therefore, these children were excluded from the all subsequent group comparisons between our ASD and NT children. When comparing writers and non-writers within the ASD group, no significant differences were found between children with regards to chronological age, $t(27) = 1.08$, $p = .29$, gender, χ^2 (1, $N = 29$) = 3.49, $p = .06$, $\Phi = -.35$, SRS-2 T-scores, $t(20) = .38$, $p = .71$, CARS-2 T-scores, $t(27) = -1.62$, $p = .12$, or WASI-II Matrix Reasoning Scores, $t(27) = 1.97$, $p = .06$. However, non-writers scored lower on FSIQ, $t(27) = 3.03$, $p = .005$, the WASI-II Vocabulary Subtest, $t(27) = 3.14$, $p = .004$, and the CELF-5 Core Language Score, $t(27) = 2.54$, $p = .02$. Non-writers with ASD also scored lower on handwriting fluency, $t(27) = 2.36$, $p = .03$, handwriting errors, $t(27) = -2.43$, $p = .02$, and keyboarding fluency, $t(27) = 2.80$, $p = .01$, but not handwriting legibility, $t(27) = -1.08$, $p = .29$, compared to writers with ASD.

Group Differences Between ASD and NT Writers

Examining the group differences between ASD and NT writers, we found that children with ASD ($n = 24$) did not differ from NT children in terms of chronological age, $t(52) = .87$, $p = .39$, gender distribution, χ^2 (1, $N = 53$) = 3.40, $p = .07$, $\Phi = .26$, race/ethnic distribution, χ^2 (5, $N = 53$)

= 5.33, p = .38, Φ = .32, or WASI-II Matrix Reasoning, $t(52) = -1.90$, p = .07. However, children with ASD scored lower on FSIQ, $t(52) = -2.63$, p = .01, the WASI-II Vocabulary Subtest, $t(52) = -2.66$, p = .01, the CELF-5 Core Language Score, $t(52) = -2.54$, p = .01, and the SRS-2 T-score, $t(52) = 7.03$, p = .0001, compared to NT children. Given the wide-age range (8-14 years) and the discrepancy between diagnostic groups in terms of IQ and language ability, children's chronological age and FSIQ scores were used as covariates in subsequent group comparisons. FSIQ was chosen as the covariate as it encompassed the Vocabulary Subtest score, and was highly correlated with the CELF-5 Core Language Score, i.e., $r(50) = .74$, p = .0001. See Table 4 for means and standard deviations of group matching variables. See Table 4.

Examination of Personal Narrative and Expository Writing Between Diagnostic Groups

Mixed-model ANCOVAs were conducted with Diagnostic Group (ASD, NT) as the between-subjects variable, Text Type (Personal Narrative, Expository Essay) as the within-subjects variable, and age and FSIQ as covariates, for all text variables, except quality. Separate one-way ANCOVAs were run to assess writing quality for each text type as different coding schemas were used to score this outcome. See Table 5 for means and standard deviations for each text variable assessed. Moreover, Appendix F provides examples of the personal narrative and expository texts produced by children with and without ASD.

Productivity.

In terms of length, or productivity, a main effect of Diagnostic Group was found, $F(1, 49) = 4.79$, p = .03, η_p^2 = .09, showing that across writing conditions, the texts of children with ASD were less productive or fluent than those of NT children. However, no significant main effect of Text Type, $F(1, 49) = .03$, p = .88, η_p^2 = .001, or Diagnostic Group x Text Type interaction was found, $F(1, 49) = .41$, p = .53, η_p^2 = .008 (Table 5).

Table 4. Comparisons of Children with and without ASD on Matching Variables and Writing Mechanisms[1]

	Children with ASD (N = 24)	NT Children (N = 29)
WASI-II		
FSIQ-2**	92.67 (13.50)	100.96 (9.16)
Vocabulary Subtest**	45.25 (10.67)	51.64 (6.41)
Matrix Reasoning Subtest	45.75 (8.71)	50.04 (7.56)
CELF-5 Core Language Score*	92.42 (19.20)	103.68 (12.47)
Handwriting Fluency (words/min.)*	9.21 (4.81)	12.85 (5.66)
Handwriting Errors (errors/total letters)	2.50% (4.50)	0.09% (1.50)
Handwriting Legibility (% of legible handwriting)	89.32% (10.90)	92.05% (7.74)
Keyboarding Fluency (words/min.)	10.02 (4.72)	13.40 (7.16)
Keyboarding Errors (errors/total letters)	1.70% (3.12)	1.00% (1.31)
Unexpected Contents Task (%)		
Pass	24	29
Fail	0	0
Birthday Puppy Total (out of 6)**	3.79 (1.89)	4.93 (.86)
Strange Stories Test (out of 16 points)***	5.92 (4.16)	11.25 (1.90)
ToM Total***	9.71 (5.75)	16.19 (2.28)
BRIEF-2		
Global Executive Composite*	66.06 (11.87)	53.65 (19.29)
Behavioral Regulation Index***	63.17 (11.88)	49.30 (10.52)
Emotion Regulation Index***	67.00 (10.82)	48.57 (10.97)
Cognitive Regulation Index***	62.83 (11.87)	47.57 (10.72)
WCST Perseverative Errors Standard Score	105.45 (39.13)	111.00 (21.12)
Tower of Hanoi		
Problems Solved (out of 7)**	5.12 (2.26)	6.56 (.79)
Avg. Number of Moves per Trial*	10.20 (3.23)	12.42 (3.34)
Avg. Time to First Move (seconds)	2.03 (1.85)	1.81 (1.57)
Avg. Time to Complete Problem (seconds)	29.88 (9.26)	36.19 (14.35)
Avg. Time per Move (seconds)	0.37 (0.11)	0.39 (.13)

Note. [1] Comparisons are between the final sample of children (N_{ASD} = 24; N_{NT} = 29), which only includes children who were able to complete the writing tasks. WASI-II = Wechsler Abbreviated Scale of Intelligence, Second Edition. CELF-5 = Clinical Evaluation of Language Fundamentals, Fifth Edition. BRIEF-2 = Behavior Rating Inventory of Executive Function, Second Edition. WCST= Wisconsin Card Sorting Test. * $p < .05$; ** $p < .01$; *** $p < .001$.

Lexical Complexity.

When examining lexical diversity (i.e., number of different words out of 50), only 16 children with ASD and 20 NT children were able to write 50 or more words, and therefore not all children were included in this analysis. Our findings revealed that among this subset of children there was no significant main effect of Diagnostic Group, $F(1, 32) = .29$, $p = .60$, $\eta_p^2 = .01$, or Text Type, $F(1, 32) = .59$, $p = .45$, $\eta_p^2 = .02$. See Table 5.

For frequency of big words, a main effect of Text Type approached significance, $F(1, 49) = 3.31$, $p = .08$, $\eta_p^2 = .06$, where bigger words were used more frequently when writing expository texts compared to personal narrative texts. However, no effect of Diagnostic Group, $F(1, 49) = .12$, $p = .73$, $\eta_p^2 = .002$, or Diagnostic x Text Type interaction were found, $F(1, 49) = 2.77$, $p = .10$, $\eta_p^2 = .10$.

When examining frequency of rare words, children with ASD used a greater frequency of rare words when writing compared to their NT peers, $F(1, 49) = 7.36$, $p = .009$, $\eta_p^2 = .13$. Yet, no effect of Text Type, $F(1, 49) = .02$, $p = .89$, $\eta_p^2 = .0001$, or Diagnostic x Text Type interaction, $F(1, 49) = 2.06$, $p = .16$, $\eta_p^2 = .04$, emerged.

Syntactic Complexity.

As shown in Table 5, an ANCOVA revealed that children's expository essays and personal narratives did not differ in their syntactic complexity, $F(1, 49) = .03$, $p = .89$, $\eta_p^2 = .001$. Therefore, the sentences written by children with ASD were similar in mean length, and their texts contained a similar number of complex of t-units and noun phrases. Moreover, the texts produced by children with ASD were just as syntactically complex as those produced by NT children, $F(1, 49) = .04$, $p = .85$, $\eta_p^2 = .001$. Moreover, no significant Diagnostic Group x Text Type interaction, $F(1, 49) = .01$, $p = .92$, $\eta_p^2 = .001$, was found.

Frequency of Grammatical Errors.

A main effect of Diagnostic Group was found when assessing the frequency of grammatical errors, $F(1, 49) = 6.18$, $p = .02$, $\eta_p^2 = .11$. More specifically, children with ASD made more grammatical errors when writing than NT children. However, the frequency of grammatical errors did not differ as the result of text type, $F(1, 49) = 1.05$, $p = .31$, $\eta_p^2 = .02$. Moreover, no significant Diagnostic Group x Text Type interaction was found, $F(1, 49) = .03$, $p = .87$, $\eta_p^2 = .001$.

Writing Conventions.

An ANCOVA conducted on the use of writing conventions showed that a main effect of Diagnostic Group approached significance $F(1, 49) = 3.52$, $p = .07$, $\eta_p^2 = .07$. In particular, children with ASD scored slightly lower on writing conventions, or made slightly more punctuation, capitalization, and spelling errors, compared to NT children. However, the use of writing conventions did not differ by writing genre, $F(1, 49) = 2.02$, $p = .16$, $\eta_p^2 = .04$.

Evaluation.

Although a mixed-model ANOVA originally revealed a main effect of Text Type, $F(1, 51) = 15.28$, $p = .0001$, $\eta_p^2 = .23$, once we controlled for age and FSIQ, this significant main effect disappeared, $F(1, 49) = .64$, $p = .43$, $\eta_p^2 = .01$. Moreover, no main effect of Diagnostic Group, $F(1, 49) = .17$, $p = .74$, $\eta_p^2 = .002$, or Diagnostic Group x Text Type interaction was found, $F(1, 49) = .04$, $p = .86$, $\eta_p^2 = .001$. In the personal narrative condition, 58% of the evaluative devices were emotive/cognitive states, 20% were character speech, 14% were causal statements, 4% were intensifiers, 2% were subjective remarks, 1% were negatives, and 1% were hedges. In the expository condition, 57% of the evaluative devices were emotive/cognitive

states, 21% were causal statements, 8% were subjective remarks, 6% were intensifiers, 4% were character speech, 2% were negatives, and 2% were hedges.

However, when examining the diversity of evaluative devices used when writing, analyses revealed the main effect of Text Type was approaching significance, $F(1, 49) = 3.28$, $p = .08$, $\eta_p^2 = .06$, even after controlling for age and FSIQ. More specifically, the diversity of evaluative devices tended to be higher for personal narrative texts compared to expository texts. However, the diversity of evaluative devices used did not differ by diagnostic group, $F(1, 49) = .44$, $p = .51$, $\eta_p^2 = .009$. See Table 5.

Quality.

For personal narrative texts, ANCOVA revealed that children with ASD scored significantly lower on overall quality (i.e., coherence, structure, content) compared to NT children, $F(1, 49) = 4.23$, $p = .04$, $\eta_p^2 = .08$. However, for expository texts, results showed no significant difference between children with and without ASD for overall quality, $F(1, 49) = 1.46$, $p = .23$, $\eta_p^2 = .03$. See Table 5.

Table 5. Comparison of Personal Narrative and Expository Writing in Children with and without ASD

Composite	Variable	Personal Narrative		Expository	
		ASD	NT	ASD	NT
Productivity[a]	Total words	80.92 (70.32)	103.00 (73.73)	80.54 (53.53)	111.93 (79.97)
	Total T-units	8.63 (6.41)	10.54 (7.12)	8.75 (5.82)	11.18 (7.28)
Lexical Diversity	NDW/50 Words[*]	35.55 (3.20)	35.89 (3.05)	35.57 (5.06)	34.30 (4.22)
	Big words/Total words	0.09 (.04)	0.11 (.05)	0.12 (.07)	0.11 (.06)
	Rare words/Total words[a]	0.07 (.06)	0.06 (.03)	0.13 (.06)	0.08 (.05)
Syntactic Complexity[b]	MLTU	9.21 (3.13)	9.68 (2.53)	9.43 (3.61)	10.01 (4.39)
	Complex T-units	0.62 (.53)	0.84 (.35)	0.56 (.59)	0.83 (.53)
	Average noun phrase length	2.00 (.52)	2.06 (.34)	2.05 (.74)	2.06 (.46)
Grammatical Accuracy[a]	Grammar errors/T-unit	0.31 (.52)	0.08 (.14)	0.26 (.32)	0.07 (.11)
Writing Conventions	Punctuation errors/T-unit	0.62 (.64)	0.43 (.36)	0.51 (.50)	0.32 (.32)
	Spelling errors/T-unit	1.01 (1.64)	0.48 (.45)	0.98 (1.63)	0.54 (.66)
	Capitalization errors/T-unit	0.55 (.62)	0.38 (.32)	0.53 (.55)	0.46 (.95)
Evaluation	Evaluative devices/T-unit	0.45 (.30)	0.48 (.32)	0.27 (.30)	0.24 (.28)
	Diversity of evaluative devices (out of 7)	1.83 (1.20)	1.61 (1.03)	1.17 (1.01)	1.14 (1.04)
Quality[a] (score 0 - 4)	Coherence	2.61 (1.45)	3.43 (.79)	2.33 (1.34)	2.90 (1.07)
	Structure	2.09 (1.59)	2.93 (.98)	1.35 (.70)	1.79 (1.07)
	Content	2.08 (1.30)	2.61 (1.07)	1.73 (1.21)	2.22 (1.32)

Examination of Behavioral Differences on Writing Tasks

Several behavioral differences in writing performance between children with and without ASD were also noted by experimenters. More specifically, the experimenter needed to redirect the attention of children with ASD to the writing task at a greater frequency than NT children, i.e., Narrative: χ^2 (1, N = 53) = 7.91, p = .01, Φ = .39; Expository: χ^2 (1, N = 53) = 6.45, p = .01, Φ = .35. Additionally, children with ASD were more likely to need additional prompting (Narrative: χ^2 (1, N = 53) = 10.32, p = .001, Φ = .35; Expository: χ^2 (1, N = 53) = 9.72, p = .002, Φ = .43), or help with idea generation before they would begin or complete the writing task, (Narrative: χ^2 (1, N = 53) = 9.58, p = .002, Φ = .43; Expository: χ^2 (1, N = 53) = 7.14, p = .03, Φ = .37). See Table 6 for frequencies of these behavioral observation.

Table 6. Behavioral Observations of Writing Ability

	Personal Narrative		Expository Essay	
	Children with ASD	NT Children	Children with ASD	NT Children
Needed Attention Redirection[ab]	25%	0%	21%	0%
Needed Prompting[ab]	45%	7%	50%	10%
Needed Help with Idea Generation[ab]	38%	3%	41%	10%

Note. [a] significant group differences for personal narrative text. [b] significant group differences for expository texts.

Assessing Children's Knowledge of Narrative and Essay Structure

When examining children's ability to describe important structural elements of narratives and essays (1 = has no grasp; 4 = has very good grasp), t-tests revealed that children with ASD did not differ from their NT peers for either narrative knowledge, t(52) = -1.70, p = .10, or essay

knowledge, $t(52) = -1.68$, $p = .11$, with average ratings that fell between "has some grasp" and "has a pretty good grasp." Interestingly, for the NT group, older children had greater knowledge of a given writing style $r(24) > .67$, $p < .01$, and knowledge of each writing style was related to their respective quality ratings, $r(24) > .54$, $p < .04$. For children with ASD, no such relations were found between children's ability to describe a given writing style and their age, $r(20) < .37$, $p > .11$, or writing quality, $r(20) < .36$, $p > .13$.

Examination of Writing Attitudes

When examining children's average rating (1 = really dislike to 4 = really like) on the writing attitudes composite score from the Writing and Reading Attitude Measure (Graham et al., 2012), no significant differences were found between children with ASD ($M = 1.96$, SD = .72) and NT children ($M = 2.11$, SD = .56) on their feelings about writing, $t(51) = -.76$, $p = .45$. Moreover, children with ASD did not differ from NT children on the amount of time they reportedly spend planning before writing, χ^2 (2, $N = 53$) = 3.26, $p = .20$, $\Phi = .28$, with 5% reporting they spend *no time* planning before they begin, 60% reporting they spend *a few minutes* planning before they begin, and 35% reporting they spend *a little longer* (> 10 minutes) planning out what to write before they begin. Similarly, children across diagnostic groups didn't differ in the reported frequency with which they typically edit their writing before turning it in, χ^2 (2, $N = 53$) = 2.31, $p = .32$, $\Phi = .23$. Eleven percent of children reported they *never* edit their writing, 63% reported they *sometimes* edit their writing, and 26% reported they *always* edit their writing.

Finally, children were asked to report what they believed to be the most challenging part about writing. Their responses resulted in five categories: (1) handwriting/physically writing, (2) idea generation/expansion, (3) editing/appropriate use of writing conventions (e.g., spelling, capitalization, grammar), (4) attention/motivational issues (e.g., "it's boring"), and (5) disliking a

specific writing style (i.e., "I hate writing research papers). Although no significant differences were found in the frequency distribution of these categories, χ^2 (4, N = 41) = 8.08, p = .09, Φ = .44, children with ASD were more likely than NT children to cite issues with handwriting or physically writing, and NT children were more likely than children with ASD to cite issues with idea generation. See Table 7 for the breakdown by diagnostic group.

Table 7. Children's Reports of the Most Challenging Aspect of Writing

	Children with ASD	NT Children
Handwriting/Physically Writing	28%	4%
Idea Generation/Expansion	17%	48%
Editing/Use of Writing Conventions	39%	30%
Attention/Motivational Issues	11%	4%
Mention of Specific Writing Style	5%	4%

Group Differences on Handwriting, Keyboarding, ToM, and EF Ability

Handwriting and Keyboarding Assessment.

When examining differences in handwriting fluency, independent samples t-tests revealed that children with ASD did differ from NT children in their handwriting fluency, t(52) = -2.35, p = .02. More specifically, children with ASD wrote fewer letters or words per minute compared to their NT peers. No significant differences were found though between children with ASD and NT children in regards to handwriting legibility, t(52) = 1.01, p = .32, frequency of errors on the handwriting task, t(52) = 1.55, p = .13, keyboarding fluency, t(51) = -2.00, p =

.06, and frequency of errors on the keyboarding task, $t(52) = 1.01$, $p = .22$. Moreover, the number of words per minute did not differ between handwriting and keyboarding conditions for either children with ASD, $t(23) = -1.43$, $p = .17$, or NT children, $t(28) = -.70$, $p = .49$ (see Table 4). In fact, keyboarding fluency was significantly positively correlated to handwriting fluency for both children with ASD, $r(22) = .69$, $p = .002$, and NT children, $r(27) = .81$, $p = .0001$.

Theory of Mind.

As shown in Table 4, we found that all children with ASD as well as NT children passed the first-order false belief task, i.e., the Unexpected Contents Task. When examining differences on the Birthday Puppy Test, our analysis showed that children with ASD scored lower on second-order false belief reasoning compared to NT children, $t(52) = -2.86$, $p = .01$. Similarly, children with ASD scored significantly lower than their NT peers on the measure of higher-order ToM, the Strange Stories Test, $t(52) = -6.09$, $p = .0001$. Given the lack of group differences on the first-order false belief task, a total ToM score (out of 22) was created that just summed the scores on the Birthday Puppy Test (out of 6) and the Strange Stories Test (out of 16). The ToM total score was used in all subsequent analyses.

Executive Functioning.

Looking first at parent reports of EF in every-day scenarios (i.e., scores on the BRIEF-2), our analyses revealed that children with ASD scored higher (i.e., greater levels of executive dysfunction) than their NT peers on all indices, including the behavior regulation index, $t(39) = 3.96$, $p = .0001$, emotion regulation index, $t(39) = 5.37$, $p = .0001$, cognitive regulation index, $t(39) = 4.32$, $p = .0001$, and global executive composite score, $t(39) = 2.35$, $p = .02$. This indicated that children with ASD had a higher level of executive dysfunction in all areas compared to NT children.

We then assessed children's performance on the lab-based experimental measures of EF. When examining performance on the WCST-64, we found that children with ASD did not differ from NT children in their cognitive flexibility as measured by the standardized preservative error score, $t(52) = -.64$, $p = .52$. For the Tower of Hanoi, analyses revealed that children with ASD solved fewer problems than NT children, $t(52) = -2.89$, $p = .01$, but they also solved these problems in fewer moves on average than their NT peers, $t(52) = -2.03$, $p = .05$. No group differences were found in terms of planning time, i.e., time to first move, $t(52) = -.44$, $p = .67$, or time per move, $t(52) = -.32$, $p = .75$. See Table 4 for means and standard deviations.

Relation between Writing, Individual Characteristics, and Mechanisms

Given the number of variables being assessed and the small sample size, Pearson correlations were used in lieu of regression analyses to examine the relations between writing ability and the following individual characteristics: (1) chronological age, (2) FSIQ, (3) language, (4) handwriting and keyboarding ability, (5) ToM, and (6) EF. For all correlation analyses presented below, the average score of each writing variable was used, collapsing across personal narrative and expository writing conditions. This was done for ease of presentation given the large number of writing variables assessed across the two writing tasks in children with and without ASD. However, additional correlation tables (i.e., Table 9, Table 10) can be found at the end of the manuscript that illustrate the individual correlation results for personal narrative and expository writing, respectively.

Chronological Age.

As shown in Table 8, chronological age was positively related to writing productivity, and negatively related to writing conventions for both children with ASD and NT children. Therefore, older children wrote longer texts that had fewer spelling, punctuation, and

capitalization errors. However, for NT children, chronological age was also related to the overall quality of written expression. Age was not related to any other text variables for either diagnostic group (see Table 8).

Full-Scale IQ.

For children with ASD, FSIQ was only significantly related to the lexical diversity of their sentences, where children with a higher IQ used a greater number of different words in a 50-word sample of text, $r(22) = .58$, $p = .02$. In NT children, FSIQ was significantly related to the productivity, $r(27) = .39$, $p = .04$, and overall quality of writing, $r(27) = .41$, $p = .03$. No other associations were found between FSIQ and writing ability in children with and without ASD, $r(22 - 27) < .36$, $p > .08$.

Language Ability.

As illustrated in Table 8, when examining the relation between writing and language ability (measured by the CELF-5 Core Language Score), correlational analyses revealed that language ability was positively related to lexical diversity and writing quality in children with ASD. For NT children, language ability was positively related to overall writing quality. No other significant associations were found between the Core Language Score and writing ability in children with or without ASD.

Handwriting and Keyboarding Skills.

Although handwriting fluency was not related to any aspect of writing measured in children with ASD, their keyboarding fluency was positively related to their writing productivity (see Table 8). For NT children, handwriting fluency and keyboarding fluency were positively related to writing productivity and quality, and negatively related to the frequency of writing convention errors. Additionally, as shown in Table 8, keyboarding fluency was positively

related to syntactic complexity and the use of evaluation in NT children. For children with ASD, handwriting legibility was significantly related to the frequency of rare words used, writing convention errors, and overall writing quality. In contrast, no significant associations were found between handwriting legibility and writing performance for NT children (see Table 8).

Theory of Mind.

In children with ASD, overall ToM ability was significantly related to the syntactic complexity and the quality of children's writing for both text types. For NT children, a slightly different pattern of findings emerged: ToM ability was significantly related to writing productivity, the use of writing conventions, and overall writing quality. ToM ability was not related to any other aspects of writing in children with and without ASD (see Table 8 for correlation values).

Executive Functioning.

Three different EF scores were examined in relation to writing ability: the global executive composite (GEC) from the BRIEF-2, the perseverative error score from the WCST-64 to assess cognitive flexibility, and the planning score (i.e., average time to first move) from the Tower of Hanoi. As shown in Table 8, no significant relations were found between GEC and writing ability for children with ASD. However, for NT children, the GEC score was negatively related to the NDW/50, the frequency of big words, and overall quality, and positively related to the frequency of errors when using writing conventions. Therefore, NT with better every-day EF skills wrote texts that were more lexically diverse, used larger words, made fewer writing convention errors, and were rated as higher quality.

Looking at the lab-based EF measures, few associations were found between writing ability and cognitive flexibility or planning. For children with ASD, cognitive flexibility was positively correlated with the lexical diversity of written expression. No relations were found between cognitive flexibility and writing for NT children. Moreover, planning as measured by the Tower of Hanoi was not related to any text variables measured in either children with ASD or NT children (see Table 8).

Assessing Predictors of Writing Quality

Finally, linear multiple regression analyses were conducted to determine how diagnostic group (ASD, NT), age, oral language ability (i.e., Core Language Score), and ToM knowledge uniquely predicted the quality of children's writing. These four predictors were entered simultaneously in the regression model. Separate regression analyses were conducted for each writing task (i.e., personal narrative, expository).

Personal Narrative Quality.

The results showed that overall the predictors accounted for a significant amount of variance in children's personal narrative writing quality, $F(4, 49) = 11.94$, $p = .0001$, $R^2 = .50$. Further inspection revealed that both ToM, $\beta = .35$, $t(48) = 3.18$, $p = .003$, and age were unique predictors of narrative quality, $\beta = .44$, $t(48) = 2.57$, $p = .01$. However, Diagnostic Group, $t(48) = .04$, $p = .30$, age, $t(48) = .30$, $p = .77$, and oral language ability, $\beta = .21$, $t(48) = 1.53$, $p = .13$, were not significant predictors of narrative writing quality.

Expository Essay Quality.

Regression analyses revealed that overall the four predictors accounted for a significant amount of variance in children's expository writing quality, $F(4, 49) = 9.02$, $p = .0001$, $R^2 = .43$. However, only age was a significant unique predictor of expository essay quality once all

predictors were accounted for, β = .41, $t(48) = 3.48$, $p = .001$. Therefore, diagnostic group, β = .01, $t(48) = .08$, $p = .94$, oral language ability, β = .21, $t(48) = 1.38$, $p = .17$, and ToM, β = .36, $t(48) = 1.98$, $p = .06$, did not account for a significant amount of unique variance in expository writing quality.

Table 8. Correlations Between Writing Ability, Individual Characteristics, and Mechanisms

CHILDREN WITH ASD

	Age	Language Ability	Handwriting Fluency	Handwriting Legibility	Keyboarding Fluency	ToM Total	BRIEF-2 GEC	Cognitive Flexibility	TOH Planning
Productivity	**.63****	-.03	.38	.22	**.50***	.23	-.12	.05	-.35
Syntactic Complexity	.37	.35	.15	-.30	.06	**.61****	.19	.26	-.31
NDW/50	-.07	**.61***	-.35	.18	.25	.52	.26	**.60***	.11
Big Words	.30	-.09	.06	.06	.17	-.12	.44	.34	-.43
Rare Words	-.08	.19	-.08	**.69****	.03	.04	.34	.11	.04
Grammar Errors	-.21	-.05	-.13	-.36	-.17	-.13	.20	-.23	-.08
Writing Conventions	**-.43***	.11	.08	**-.43***	-.32	.20	.02	-.31	.28
Evaluative Devices	.26	.05	.01	.01	.22	.05	.23	.11	-.23
Quality	.37	**.40***	-.08	**.45***	.14	**.66*****	.09	.23	-.05

NT CHILDREN

	Age	Language Ability	Handwriting Fluency	Handwriting Legibility	Keyboarding Fluency	ToM Total	BRIEF-2 GEC	Cognitive Flexibility	TOH Planning
Productivity	**.80*****	.30	**.76*****	.03	**.82*****	**.52****	-.41	.37	-.15
Syntactic Complexity	.29	.21	.22	.18	**.62****	.12	-.09	.10	-.20
NDW/50	-.24	.15	-.09	.19	-.04	.15	**-.50***	-.08	-.07
Big Words	.01	**.42***	.27	.01	.13	.12	**-.49***	.25	-.27
Rare Words	.34	.08	.37	.22	.13	.22	-.25	.28	.20
Grammar Errors	.15	-.32	-.08	-.05	-.22	.03	-.12	.09	.18
Writing Conventions	**-.52****	-.16	**-.47***	-.02	**-.71*****	**-.48****	**.56****	-.33	-.13
Evaluative Devices	.27	-.01	.34	.10	**.47***	.20	-.06	.22	-.30
Quality	**.67*****	**.45***	**.73*****	.06	**.73*****	**.46***	**-.57****	.25	-.11

Note. NDW/50 = Number of different words out of 50 words. Language ability was assessed using the Core Language Score from the CELF-5. BRIEF-2 = Behavior Rating Inventory of Executive Function, Second Edition. GEC = Global Executive Composite. Cognitive flexibility was measured using the perseverative error score from the Wisconsin Card Sorting Task. TOH = Tower of Hanoi. $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

Table 9. Correlations Between Personal Narrative Writing Ability, Individual Characteristics, and Mechanisms

CHILDREN WITH ASD									
	Age	Language Ability	Handwriting Fluency	Handwriting Legibility	Keyboarding Fluency	ToM Total	BRIEF-2 GEC	Cognitive Flexibility	TOH Planning
Productivity	**.56****	-.03	.23	-.37	.38	.25	-.11	.05	-.32
Syntactic Complexity	.26	**.41***	.04	-.29	-.04	**.70*****	.31	.38	-.29
NDW/50	**.51****	.16	.08	.15	.43	.07	.11	**.63***	.01
Big Words	.40	**.40***	.11	.05	.25	-.37	-.04	.17	-.43
Rare Words	-.01	.33	-.08	.34	.02	.34	.08	.30	.31
Grammar Errors	-.17	.17	-.06	.29	-.13	-.04	.26	.12	-.05
Writing Conventions	**-.44***	.05	.09	.33	-.38	.10	-.06	-.26	.32
Evaluative Devices	-.03	.20	-.12	.03	-.09	.14	.23	.24	-.24
Quality	**.40***	.35	-.12	**.47***	.21	**.56****	-.08	.16	-.02
NT CHILDREN									
	Age	Language Ability	Handwriting Fluency	Handwriting Legibility	Keyboarding Fluency	ToM Total	BRIEF-2 GEC	Cognitive Flexibility	TOH Planning
Productivity	**.72*****	.22	**.66*****	-.11	**.61****	**.37***	-.32	.26	-.11
Syntactic Complexity	**.39***	.22	**.36**	-.10	**.64***	.21	-.06	.15	-.31
NDW/50	**.84*****	**.49***	.08	-.30	.16	.01	-.40	-.09	.27
Big Words	-.19	-.33	-.37	-.27	.21	-.34	-.22	.26	-.33
Rare Words	-.18	**-.49****	-.26	.03	.09	-.18	-.05	-.13	-.10
Grammar Errors	.08	**-.48****	-.29	.04	-.09	-.24	-.17	.27	.22
Writing Conventions	**-.57****	-.14	**-.45***	-.08	**-.62****	**-.48****	**.61****	-.30	-.08
Evaluative Devices	.27	.16	.36	-.07	**.47***	.31	**-.43***	.18	-.14
Quality	**.49****	**.51****	**.76*****	.18	**.58*****	**.53****	**-.58****	-.13	.16

Note. NDW/50 = Number of different words out of 50 words. Language ability was assessed using the Core Language Score from the CELF-5. BRIEF-2 = Behavior Rating Inventory of Executive Function, Second Edition. GEC = Global Executive Composite. Cognitive flexibility was measured using the perseverative error score from the Wisconsin Card Sorting Task. TOH = Tower of Hanoi. $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

Table 10. Correlations Between Personal Narrative Writing Ability, Individual Characteristics, and Mechanisms

	Age	Language Ability	Handwriting Fluency	Handwriting Legibility	Keyboarding Fluency	ToM Total	BRIEF-2 GEC	Cognitive Flexibility	TOH Planning
CHILDREN WITH ASD									
Productivity	**.58****	-.05	.38	.02	**.55***	.19	-.11	.15	-.32
Syntactic Complexity	.29	.30	.15	-.11	-.03	**.54****	.11	.41	.25
NDW/50	-.05	.30	-.25	.16	.14	.21	.37	.43	.09
Big Words	.13	.12	.04	.08	.05	-.02	.57*	.29	-.22
Rare Words	-.11	-.03	-.05	**.66****	.02	.25	.45	.06	.31
Grammar Errors	-.16	-.25	-.15	.28	-.20	-.14	.03	**-.61****	-.07
Writing Conventions	-.33	.16	.05	**-.49***	-.30	.24	.08	-.34	.25
Evaluative Devices	.40	-.16	.20	.32	.29	.03	.02	.04	-.13
Quality	.25	.38	-.07	**-.35**	.04	**.62*****	.31	.29	-.07
NT CHILDREN									
	Age	Language Ability	Handwriting Fluency	Handwriting Legibility	Keyboarding Fluency	ToM Total	BRIEF-2 GEC	Cognitive Flexibility	TOH Planning
Productivity	**.67*****	.30	**.63*****	.14	**.73*****	**.56****	-.38	.39*	-.13
Syntactic Complexity	.23	.19	.13	-.21	**.56****	.16	.07	.06	-.11
NDW/50	-.29	.16	-.07	.03	-.17	.27	-.43	-.03	-.29
Big Words	.18	-.37	.08	.22	.03	-.05	**-.50***	.07	-.12
Rare Words	-.30	.20	.27	-.28	.09	-.08	-.22	.41*	.24
Grammar Errors	.17	-.12	-.10	-.10	-.26	.17	-.06	.07	.14
Writing Conventions	**-.39***	-.14	**-.39***	.06	**-.69*****	-.30	.41	-.25	-.18
Evaluative Devices	.04	-.23	.10	.11	.09	-.14	.38	.08	-.22
Quality	**.65*****	.31	**.57****	.05	**.74*****	**.39***	**-.42***	.54**	-.29

Note. NDW/50 = Number of different words out of 50 words. Language ability was assessed using the Core Language Score from the CELF-5. BRIEF-2 = Behavior Rating Inventory of Executive Function, Second Edition. GEC = Global Executive Composite. Cognitive flexibility was measured using the perseverative error score from the Wisconsin Card Sorting Task. TOH = Tower of Hanoi. $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$

CHAPTER FOUR

DISCUSSION

Effective writing skills are essential for successful academic, occupational, and social outcomes (Delano, 2007). Unfortunately, past research has indicated that writing may be one of the most challenging areas of academic achievement for children and adolescents with ASD (Mayes & Calhoun, 2006). As such, more research was needed to identify how the writing skills of children with ASD specifically aligned or deviated from typical development. Although several studies have begun to comprehensively characterize the writing ability of individuals with ASD (Brown, 2013; Brown et al., 2014; Dockrell et al., 2014), they have largely focused on one writing style or another. This raised the question of whether or not children with ASD are able to write better in a particular genre, or whether they are able to make typical developmental distinctions between writing styles like their NT peers. To our knowledge, this is the first study to use fine-grained linguistic analysis to directly compare the personal narrative and expository writing ability of children with ASD to NT children.

Comparing the Writing Ability of Children with ASD and NT Children

Our findings revealed that the writing ability of children with ASD differed from their NT peers in a number of ways at both the microstructure (word and sentence) and macrostructure (text) level. At the local level, children with ASD wrote personal narrative and expository texts that were less productive and contained more grammatical errors compared to NT children. However, with the exception of grammar errors, the word and sentence level aspects of writing

seemed to be an area of strength for children with ASD. The personal narrative and expository texts of children with ASD were just as lexically diverse and syntactically complex, and included a similar frequency of spelling, punctuation, and capitalization errors, as well as evaluative devices as NT children. In fact, similar to Brown (2013) and Brown et al. (2014), children with ASD used a greater frequency of rare words compared to NT children, resulting in more lexically complex texts.

While others have found few word and sentence level differences between children with and without ASD (Brown et al., 2014), it was unexpected that children with ASD employed a similar range and frequency of evaluative devices (i.e., linguistic strategies employed to maintain audience involvement in a story) as NT children. Indeed, in the present study, a number of children with ASD were particularly adept at discussing emotions and cognitions and incorporating character speech into their personal narratives. However, our expectation that children on the spectrum would be impaired in the use of evaluation rested largely on research on *oral* narration (Losh & Capps, 2003; Tager-Flusberg & Sullivan, 1995). To date, research has yet to examine the use of evaluative devices in *writing* among children with ASD. Drjibooms et al. (2017) state that in contrast to oral discourse, writing provides the narrator with greater control over their linguistic output by allowing more "off-line time to look for the appropriate words or for syntactic structures that provide a different perspective" (p. 770), which may have been the case for the children with ASD in this study.

On a global level, our findings revealed that the personal narratives of children with ASD were rated lower in overall quality, indicating they had a more difficult time than NT children writing coherent stories that were well-structured and included enough information about the story setting, characters, and actions. In contrast, when using a similar coding rubric, we found

that the expository texts of children with ASD did not differ from their NT peers in terms of coherence, essay structure, or inclusion of appropriate background information. This relative advantage for expository writing falls in line with previous research that has shown that descriptive forms of text (Brown & Klein, 2011; Galter, 2008; Randi, 2010) and discourse (Kroenke, 2015) are typically easier for individuals with ASD than narrative forms.

It is believed that this difficulty with narrative writing, especially writing about oneself, is due to its increased reliance on social cognition, imagination, and autobiographical memory (Happé, 1991), which can be challenging skills for individuals with ASD (Crespi, Leach, Dinsdale, Mokkonen, & Hurd, 2016; Lind, 2010). In contrast, the expository writing task we used may have played on the strengths of the children with ASD by allowing them to pick a topic that they were interested in and knew something about. Indeed, Siverston (2010) found that in a small sample of children with ASD that students' special interest area positively affected the quality of their writing. More specifically, when four children with ASD completed four writing prompts—two selected by their teacher and two based on their special interests—Siverston found a significant improvement in children's sentence fluency and their ability to share their thoughts and feelings when writing about their special interest.

Cross-Genre Differences in Writing Ability

Looking more closely at inter-genre differences, we found that children's personal narrative texts included a slightly greater frequency and range of evaluative devices compared to expository texts (Bamberg & Damrad-Frye, 1991; Labov & Waletzky, 1967). However, contrary to previous research (Berman & Nir-Sagiv, 2004, 2007), there was not a comparative advantage for syntactic (i.e., MLTU, complex T-units, average noun phrase length) or lexical complexity (i.e., number of different words, rare words, and large words) in expository texts. This may have been

the result of the age range (8 -14 years) included in this study. Despite the general trend that expository writing typically includes more complex syntax and abstract vocabulary than narrative writing, Scott (2010) suggests that there still may be developmental windows for various aspects of writing. More specifically, when Berman & Nir-Sagiv (2004, 2007) examined narrative and expository writing from 4th grade to adulthood they found that it took "until adolescence to deploy a large range of linguistic forms flexibly and appropriately to meet the cognitive and communicative requirements of different types of discourse" (Berman, 2008; p. 762). Additional research is needed to examine whether older individuals with ASD make similar syntactical and lexical distinctions between narrative and expository texts. Another possibility may be that the brief nature of many children's texts (e.g., less than 50 words) did not provide them enough "time" to shine syntactically and lexically.

In terms of quality, we were not able to directly compare text types as they had different coding schemas for scoring text structure and content. Nevertheless, examining the average ratings for each of these subscales we can see that there was a tendency for both children with and without ASD to have lower holistic ratings for expository texts compared to personal narrative texts. This trend falls in line with previous research demonstrating that children often master the organizational elements of narrative writing before expository (Berman & Nir-Sagiv, 2004, 2007). Collectively, these findings illustrate that both groups of children showed some sensitivity to the specific communicative purposes of each writing style.

Behavioral Observations and Writing Attitudes

In addition to local and global text differences, several surprising and interesting findings emerged regarding the writing process of children with ASD. Firstly, 17% of the children with ASD were unable to produce texts independently on the computer. This finding is similar to that

of Dockrell et al. (2014) who found that approximately 20% of the children with ASD and LI refused to write by hand in their study. Recall that our non-writers had significantly lower IQ scores, oral language skills, and handwriting fluency scores than ASD writers, and therefore, it is not entirely unexpected that they would be less likely to write. Secondly, experimenter observations revealed that among the writers, children with ASD were more likely to need help with *idea generation, reminders to focus or attend* to the writing task, and *neutral prompting* to continue writing. Sivertson (2010) also observed that the children with ASD in her study had "great difficulties with initiating and completing writing tasks in the classroom" (p. 24), despite receiving Written Expression scores on the WJ-III (Woodcock, McGrew, & Mather, 2001) in the average range.

It is important to note that in terms of idea generation, children with ASD were not only more likely to need help, but it often took them much longer than their peers to come up with their story or topic, even when help wasn't needed. This was especially true when retrieving a memory to write about in the personal narrative condition. Moreover, while the proportion of children that needed help with idea generation was equivalent across text genre, anecdotally the experimenters noted that children with ASD required *a greater amount* of continued prompting in the personal narrative condition as it was common for children with ASD to state they could not think of a time they had gotten in a fight/disagreement with someone.

Thirdly, in addition to these behavioral observations, we examined children's feelings towards writing. Despite having similar general attitudes, children with ASD were more likely to identify lower-level processes of writing (e.g., handwriting, attention/motivation, spelling) as the most challenging aspect of writing compared to NT children whose most common complaint was idea generation. When also taking into consideration the decreased handwriting fluency

found among children with ASD, it may be that many of the children with ASD in our sample are still gaining automaticity in their writing. Finally, we assessed children's genre knowledge. Surprisingly, children with ASD did not differ from NT children in their ability to define the important elements of narrative and essay writing. For NT children, however, knowledge of narrative and essay structure increased with age and was related to writing quality. In contrast, the ability to explain what a narrative or expository essay was did not necessarily translate into better writing for children with ASD. These findings suggest that the process of writing may be more challenging for children with ASD to execute, even when they understand the requirements of a given text type, or the texts they produce are equivalent to their NT peers.

The Nature of Writing Development in Children with and without ASD

Given the limited research on writing in the field of ASD, the present study also set out to examine how writing ability improved with age in children with ASD, as well as the mechanisms that could serve as potential barriers to text production and contribute to writing heterogeneity. In line with Berninger's model of the multi-leveled writing system (Berninger, 2015), we found that age, language by ear and mouth (oral language), fine-motor skills, social cognition, and EF all impacted the writing process of children in various ways. In line with previous research (Brown et al., 2014), and our age-related hypotheses, chronological age uniquely predicted the quality of both personal narrative and expository writing across children when taking into account diagnostic group, oral language ability, as well as ToM knowledge. When looking at the individual associations between age and writing, we found that text productivity, correct spelling and use of capitalization and punctuation increased with age in both children with and without ASD. However, age-related increases were also found for the overall quality of writing in NT

children, suggesting that NT children may show more developmental distinctions in writing ability.

The results of the current study also provide further evidence for the impact of our oral language system on our writing system (Berninger & Abbott, 2011). Language ability not only distinguished writers from non-writers, but also influenced written expression at the word-level, sentence-level, and text-level in children with ASD and NT children. More specifically, children with ASD with greater oral language skills were able to write more lexically diverse and texts that were rated higher in overall quality. Within our NT group, better language ability was associated with the use of larger words and the creation of higher quality texts.

When examining the relation between writing and fine-motor skills, our results indicated that the writing ability of children with ASD was impacted by how well they were able to form letters instead of by how fast they could write or type, whereas the opposite was true for NT children. Indeed, greater handwriting legibility, but not handwriting fluency, was associated with increases in the use of rare words and overall quality and decreases in spelling, capitalization, and punctuation errors for children on the spectrum. This contradicts previous research by Dockrell et al. (2014) who found that the handwriting fluency of children with ASD predicted writing productivity and grammaticality. For NT children, both handwriting fluency and keyboarding fluency, but not handwriting legibility, predicted writing performance at the local and text level. In fact, a greater number of associations were found between writing and keyboarding fluency than writing and handwriting fluency in NT children. One reason this pattern of results may have occurred could be due to the medium in which the writing task was given, i.e., on the computer versus on paper.

Children's writing ability was also associated with their ToM knowledge. We found that children with ASD with better mindreading skills also wrote more syntactically complex, coherent, and well-structured personal narrative and expository texts. Similarly, NT children with higher ToM scores wrote longer texts that were of higher quality and included fewer spelling, punctuation, and capitalization errors. Regression analyses also revealed that ToM ability predicted the quality of personal narrative writing in children even after taking age, language ability, and diagnostic group into account. As such, these results extend the work of Brown & Klein (2011) who found similar associations between ToM and writing productivity, quality, and mechanics in *adults* with and without ASD. Moreover, our findings support the theory that better ToM understanding can affect the writer's ability to take the perspective of the reader, and in turn lead to the inclusion of appropriate background information as well as explicit connections that lead the reader through the text (Colle, 2008; Loveland et al., 1990).

In line with previous studies (Assouline et al., 2012; Drijbooms, Groen, & Verhoeven, 2015; Hooper et al., 2002), EF played a role in the writing ability of children with and without ASD. However, the associations between a given EF skill (i.e., reported executive dysfunction, cognitive flexibility, and planning) and the particular writing outcome examined differed by diagnostic group. For NT children, the only associations found were between writing ability (i.e., lexical diversity, writing conventions, quality) and executive dysfunction scores as measured by the BRIEF-2. In contrast, for children with ASD, cognitive flexibility, but not planning or overall executive dysfunction, predicted the lexical complexity of writing.

The inconsistent findings may be the result of variability or lack thereof, in EF performance. First, parents of children with ASD reported significantly higher levels of executive dysfunction on the BRIEF-2 than parents of NT children. As a result, NT children

may have a had a greater range of executive dysfunction levels (low to high) compared to children on the spectrum (all relatively high). In turn, NT children with executive dysfunction scores on par with children with ASD may have then had the greatest difficulty with writing. Similarly, the standard deviation for the perseverative error score on the WSCT-64 was much higher for children with ASD compared to NT children, despite the fact that performance did not differ between children with and without ASD. Thus, the greater variability in cognitive flexibility may have been able to better capture writing heterogeneity in children with ASD. Finally, the lack of findings between writing and the planning score on the Tower of Hanoi was likely due to the limited variability found among children for this EF skill. Very few children spent a significant amount of time (i.e., more than 2 seconds) strategizing before they attempted to solve the problem. Given its believed impact on writing (Berninger et al., 2014; Hooper et al., 2002), future developmental research should examine whether other measures of planning, such as the Tower of London, are more highly associated with writing performance.

Taken together, this study provides evidence that oral language, fine-motor, and cognitive processing skills are all important mechanisms of writing development in children with ASD. Future research should explore the developmental nature of the processes that lead to these associations in children with ASD.

Limitations

Although we believe our findings are compelling, several limitations should be noted. Firstly, a wide-age range was included in this study for our sample size. While this is typical in ASD research, this may have limited our ability to detect specific age-related changes in children with ASD, as well as inter-genre differences between personal narrative and expository writing. Secondly, similar to previous reports (Brown et al., 2013; Dockrell et al., 2014; Happé, 1991),

there was substantial heterogeneity in writing ability of children with ASD and NT children, especially when it came to text productivity given that a minority of students did not write more than 50 words. This variability may have also limited our ability to detect group or genre differences in writing composition. Thirdly, the current study did not address the impact of language by eye, i.e., reading ability, on written expression. Past longitudinal research has found a strong bi-directional relation between reading and writing ability across early and middle childhood (Berninger & Abbott, 2010). Given that children with ASD often have difficulty with reading comprehension (Brown et al., 2013), it will be imperative for future research to determine the effect this may have on the written expression of children with ASD. Finally, it may be that our cross-genre writing results are unique to the specific writing tasks employed in this study. Although the prompts used in this study were deliberately selected/developed to be representative of their respective genres, studies have shown that the specific text features one would expect to find at the local and global level can vary from one task/topic to another, even within the same genre (Scott, 2010). Therefore, additional research is needed to determine whether the results found in this study hold true when different prompts are utilized.

Conclusions and Educational Implications

Using detailed linguistic and behavioral analysis, we were able to capture a number of barriers that children with ASD seem to be experiencing when writing. Children with ASD not only had problems with productivity, grammaticality, and personal narrative quality, but they also had more trouble generating ideas and maintaining focus on the writing task than NT children. Furthermore, in the present study, we found that the children who were struggling the most with writing were those with lower oral language, fine-motor, and cognitive skills. Nevertheless, children with ASD did demonstrate several strengths in writing. More specifically, children with

ASD did not differ from NT children in their use of complex vocabulary and syntax, as well as expository writing quality, and they made the same inter-genre writing distinctions as their NT peers.

Taken together, these findings may have a number of educational implications. Given the relative lack of difficulty with expository form, our results support Siverston's (2010) suggestion that educators should consider allowing beginning writers with ASD to write about topics that interest them. In turn, this may help them reach their highest academic potential in the classroom by allowing them to rely on an area of strength (e.g., special interest). Another approach to improving writing ability in children with ASD may be to work on children's foundational skills (e.g., oral language, handwriting legibility) in conjunction with the areas of greatest difficulty (e.g., explicitly teaching narrative form). Our findings also highlight the utility of taking a multidimensional approach, capturing both qualitative and quantitative measures of writing, as well as children's level of linguistic, motor and cognitive development, when assessing writing for educational decisions (Dockrell et al., 2014; Saddler & Asaro-Saddler, 2013). By doing so, clinicians and educators may be able to develop more individualized, effective interventions to support the written expression goals of children with ASD.

APPENDIX A

CHILD INFORMATION FORM

Child's Name: _____ Gender: Male Female

Child's Date of Birth: _____/_____/_____
Month/Day/Year

Racial/Ethnic Identify of Child:
_____African American
_____Caucasian
_____Latino/Latina
_____Middle Eastern
_____Asian American
_____Native American
Mixed Race (please specify): _____
Other (please specify): _____

Maternal Education:
_____High school, no diploma
_____High school graduate
_____Some college, no degree
_____Associate degree
_____Bachelor's degree
_____Master's degree (EX: MA, MS, MEng, MEd, MSW, MBA)
_____Professional degree (EX: MD, DDS, DVM, LLB, JD
_____Doctorate degree (EX: PhD, EdD)

Paternal Education:
_____High school, no diploma
_____High school graduate
_____Some college, no degree
_____Associate degree
_____Bachelor's degree
_____Master's degree (EX: MA, MS, MEng, MEd, MSW, MBA)
_____Professional degree (EX: MD, DDS, DVM, LLB, JD
_____Doctorate degree (EX: PhD, EdD)

Diagnostic History:
Has your child ever been diagnosed with an Autism Spectrum Disorder (please specify approx. age):
_____

How was your child's Autism Spectrum Disorder diagnosis determined? If you were given a report when you received a diagnosis, the names of any tests used should be included in the report. Please place an X next to the test(s) listed below:

_____. Childhood Autism Rating Scale (CARS)
_____. Gilliam Autism Rating Scale/2nd edition (GARS/GARS-2)
_____. Modified Checklist for Autism in Toddlers (M-CHAT)
_____. Social Responsiveness Scale (SRS)
_____. Screening Tool for Autism in 2-Year-Olds (STAT)
_____. Autism Diagnostic Interview - Revised (ADI-R)
_____. Autism Diagnostic Observation Schedule (ADOS)
_____. Vineland Adaptive Behavior Scale (VABS)
_____. Diagnostic & Statistical Manual - IV-TR Autistic Disorder Checklist (DSM-IV-TR)
_____. Gilliam Asperger's Disorder Scale (GADS)
_____. Asperger Syndrome Diagnostic Scale (ASDS)
_____. Other (please specify): _____

If you have a record of the diagnostic report, please provide your child's scores on the test that was used to determine diagnosis:

_____
_____
_____

Who provided you with an Autism Spectrum Disorder diagnosis?

_____. Pediatrician
_____. Psychiatrist
_____. Psychologist
_____. Neurologist
_____. Speech Language Pathologist
_____. Other (please indicate): _____

Additional Diagnostic History:

Has your child ever been diagnosed with any of the following conditions (please specify age)?

Tourette's: _____Age:_____
Dyslexia: _____Age:_____
Epilepsy: _____Age:_____
ADHD:_____Age:_____
Language Impairment _____Age:_____
Learning Disorder _____Age:_____
Dyspraxia_____Age:_____
Anxiety Disorder _____Age:_____
Other Diagnosis (please specify): _____
Major illnesses not listed above? _____

How was diagnosis determined (e.g. Which tests/questionnaires were used?_____
_____
_____
_____

Who provided you with the diagnosis?
_____. Pediatrician
_____. Psychiatrist
_____. Psychologist
_____. Neurologist
_____. Speech Language Pathologist
_____. Other (please indicate): _____

School History
Child's Present School _____ Grade _____
Name of School District _____
Has your child been mainstreamed? Yes No Partially

Therapy/Intervention History
Does your child currently receive ABA therapy and/or other interventions?

Yes No

If so, how long has he/she been receiving assistance?_____
_____

If your child receives ABA therapy and/or interventions, if you feel comfortable sharing, what are the main goals for your child? What aspects of your child's development are being focused on?
_____
_____
_____
_____

APPENDIX B

PARENT LITERACY AND TECHNOLOGY QUESTIONNAIRE

1. How old was your child when he/she started writing?

   Began at/around age _____

2. Please choose the best description of your child's writing ability:
   _____ Drawing
   _____ Scribbling
   _____ Letter strings
   _____ Letters with spaces
   _____ One intelligible word
   _____ Two to three words
   _____ Words in a list
   _____ Partially formed sentences
   _____ One to two sentences
   _____ Three or more unrelated sentences
   _____ Three or more related sentences
   _____ Three or more organized sentences
   _____ Two cohesive paragraphs
   _____ Three cohesive paragraphs

When writing in class (e.g., compositions, handwriting or spelling practice) what type of lined paper does your child use?
_____ Three-lined paper with ¾ to 1 in. line spacing
_____ Three-lined paper with ½ to ¾ in. line spacing
_____ Two-lined paper with no mid-line
_____Other (please explain):_____

3. How often does your child practice writing at home (either for fun or for a class assignment)?

   Seldom to never Monthly Weekly Daily

4. How often does your child need assistance with writing?

   Never Sometimes Often Always

5. In what ways do you help your child with writing?
   ____ Letter formation
   ____ I tell him/her the letter(s)
   ____ I help him/her say words slowly
   ____ I help them plan/organize his/her writing.
   ____ I help them edit, or revise, his/her writing
   ____ I help them maintain attention to their assignment.
   ____ I do not help my child with writing at this time/

   Other (please specify)_____

6. How would you describe your child's attitude about writing?

   He/she likes to write…

   Not at all a little some a lot a whole lot

7. Does your child have a particular topic that he/she enjoys writing about? If so, please specify:_____
   _____

8. Has your child had difficulty with writing in the past? If so, how old were they? What writing skills did they find challenging (e.g., handwriting, spelling, organization, etc.)?
   _____
   _____

9. Has your child received any special tutoring for writing? If so, how old were they, and how long did the tutoring last?
   _____

Feel free to provide any additional information about your child's reading and writing development below:

_____
_____
_____

10. Please rate your child based on his/her proficiency with keyboarding on a computer:

    Not at all proficient Somewhat proficient Proficient Very proficient

11. How many years of experience does your child have with using a computer? _____

12. How often does your child use a computer at school to complete assignments?

    Never once a month 1 to 2 days a week 3 or more days a week

13. How often does your child use a computer at home to complete assignments?

    Never once a month 1 to 2 days a week 3 or more days a week

14. Does your child use another type of technological device (e.g., augmentive/alternative communication device, iPad,) to complete assignments at school? Please specify:
    _____
    _____

APPENDIX C

ADDITIONAL INFORMATION REGARDING EACH EVALUATIVE DEVICE CATEGORY

The following coding schema was adapted from Losh and Capps (2003):

1) *Emotive/cognitive states and behaviors:* This category included any reference to the internal states of the writer or character's, such as simple (e.g., sadness) and complex affective states (e.g., guilt), cognitive states (e.g., believed) and the behaviors associated with these internal states (e.g., I cried). Additionally, this category included any causal explanations of a character's emotions or cognitions (e.g., "I was angry because my brother wouldn't let me play with the iPad.").

2) *Causality:* Causal statements included those in which the writer inferred the cause motivation for events or behaviors (e.g., I got in trouble because I pushed my brother).

3) *Negatives:* Negatives help define narrator perspective by including events/behaviors contrary to underlying expectations (e.g., "I didn't know that he had found my lunchbox").

4) *Hedges*: Hedges express the writer's or character's uncertainty, and thus serve as a way to characterize the event or behavior in terms of multiple, possible interpretations or perspectives (e.g., "He could have been lying though").

5) *Character speech/onomatopoeia/sound effects:* These types of evaluative devices serve as a way for the writer to hold the reader's attention by adopting character perspective through the use of character voice (e.g., My dad said, "that's too big a bite."), onomatopoeia (e.g., tick-tock), and sound effects (e.g., "the door went bang when it closed!").

6) *Intensifiers:* Intensifiers, such as emphatic lexical markers, repetition, and attention getters, are used to emphasize particular parts of a story. Emphatic markers are adverbs of intensification that emphasize the words they modify ("She was *really* sad"). Repetition of words or ideas involves the literal reiteration of words ("He talked and talked and talked") or a close paraphrase of previously mentioned ideas (e.g. "It was terrible day... that was really terrible"). Attention getters signal the importance of an event by drawing the reader's attention to specific event (e.g., "*Suddenly,* my brother stormed out of the room").

7) *Subjective remarks*: This type of device expresses the writer's opinion about an event or a person (e.g., "It was not a fun day at school").

APPENDIX D

CODING RUBRIC FOR WRITING QUALITY VARIABLES

Quality Variable	Rating	Rating Description	
		Personal Narrative	Expository
Coherence adapted from Brown et al., (2014)	0	Scarce connection between ideas; text is simply a list of ideas, statements, or thoughts; text may be very repetitive; there is likely much off topic or tangential information; text may not make sense.	Same rating
	1	Rare connections between ideas; there may be much off topic or tangential information; may still have list-like feel; text may be only somewhat understandable	Same rating
	2	Includes some connections between ideas; topic changes beginning to be smooth; may read as "choppy"; the text is generally understandable	Same rating
	3	Regularly connects ideas; may have some off topic or tangential information; topic changes are smooth; reads as relatively smooth text (not list-like); text is understandable	Same Rating
	4	Most ideas are connected; topic changes are generally smooth; contains many linked ideas; reads as a smooth text; text is understandable; text may be insightful	Same rating
Content adapted from Brown, 2013	0	No elaboration of events, characters, settings-physical events only; writing bound by context (i.e., you have to be there to understand the text); no background information	No background information, a list of reasons all or most of which do not truly answer the question or relate to the topic

	1	Minimal/limited description- may begin to describe settings, character, or events; inadequate background information	Inadequate background information, a list of related reasons, no explanations/opinions
	2	Simple/some description of characters, events, or settings	Some background information given, at least one supporting reason has been stated, reason shows limited development through supporting details
	3	Regular/clear descriptions of setting characters and events; consistent background information given	Consistent background information given, two or more reasons have been stated, at least one reason shows good development through supporting explanations/opinions
	4	Elaborate/thorough description of setting, characters, and events; extensive background information	Excellent background information given, three or more supporting reasons have been stated, at least two reasons show good development through supporting explanations/opinions
Structure (Berman & Nir-Sagiv, 2007; Brown, 2013)	0	Few or none of the basic story structure elements present; If present, events are detached; may include tangential information	Few simple sentences; no thesis statement or direct response to topic; If examples/details are present they are merely listed; no conclusion
	1	Some elements of the basic story structure may be present; However, the story is mostly an action-based sequence of past events; Story does not seem to follow a logical order	A few simple sentences (may have some complex sentences, more than just a t-unit); response to topic or position statement present, but is very brief; Supporting details are merely listed; no real explanations or conclusion

	2	Many of the elements of the basic story structure are present; story is not just an action-based sequence of events, but is beginning to focus on the emotions/intentions of 'characters'; beginning to proceed in somewhat logical order	A position statement is present; the conclusions statement may be a terminating remark not appropriate to the text or only one sentence long; all supporting information may be clumped together instead of categorized under superordinate idea
	3	Most of the elements of the basic story structure are present; story at least briefly touches on the emotions/intentions of characters; story proceeds in a mostly logical way	Introduction, supporting details or explanations, and conclusion are all present; beginning to resemble a multi-paragraph essay structure where there are clear distinctions subordinate categories (e.g., multiple paragraphs)
	4	All of the elements of the basic story structure are present; story focuses on emotions/intentions of characters; story proceeds in logical order	Text more than one paragraph and each paragraph contains a distinct subordinate category and follow-up explanations/opinions; text generally flows in an essay structure style

APPENDIX E

EXAMPLES OF THE TOPICS CHILDREN WROTE ABOUT IN PERSONAL NARRATIVE AND EXPOSITORY TEXTS

Personal Narrative Topics	**Expository Topics**
1. “My friend stole my lunchbox”	1. “Why I love transformers”
2. “I had a feud with my mom and dad”	2. “Training huskies”
3. “Me and my brother started fighting”	3. “Why I love Evee (a Pokémon)”
4. “I had a fight with my cousin over a phone”	4. “Why video games are fun”
5. “My mom made me pair up the socks”	5. “A report on Buffalo Wild Wings”
6. “Yesterday, my brother started punching me”	6. “My favorite place in the world is Monhegan”
7. “Once I got in a fight with a kid who was bullying me”	7. “My favorite game is Disney Infinity. Here’s why:”
8. “Today, me and Ben fought”	8. “A report on salamanders”
9. “I had to go to the store with my mom”	9. “How to play football”
10. “My mom got really mad at me because she thought I was being annoying”	10. “Dogs are my favorite animal”

APPENDIX F

SAMPLES OF HIGH AND LOW QUALITY PERSONAL NARRATIVES AND EXPOSITORY ESSAYS

PERSONAL NARRATIVE TEXT SAMPLES

1) 13-Year Old Neurotypical Child (Quality Score: 12)

One time I came to hockey very upset because my grades were not very god. I was not in a good mood at all. I was in 6th grade. I went into the locker room, where kids were making fun of me kind of jokingly. I took it the wrong way because I was really upset and I started to say mean things back. I was so mad. I was crying and parents had to come into the lockeroom to check on me because I was so angry. I had to be calmed down and my teamates had to appologize. But now I relize that it was just a joke. I am still friends with those people today. I just had one bad day because of how it started. I apolgized later via text to tell them I should have never accused them of something they were just kidding about.

2) 8-Year Old Neurotypical Child (Quality Score: 4)

"me and my brother got in a fight and i ran up stairs and instend of still fighting it be came a nerf war"

3) 12-Year Old Child with ASD (Quality: 11)

Pasta:
it was a night like any other
mac and cheese was for diner
i reached in for a bite yello cremy meaty mac on my spoon
i placed it in my mouth and wihtdrew my spoon
then out of the blue came my dad's voice "dex that is way to big a bite"
not again! i thought
i cold not respond for i had taken a bite
when i had swallowed i retoted "if i can fit it in my mouth and swallow it it's fine!"
this went on for awile like it alwas dose and it ended like it alwas dose in a stalemate
until the next mac and cheese diner

4) 10-Year Old Child with ASD (Quality: 3)

about trying to be first in line. I do not want to be last in line. because my stuff will be a mess. I'll feel angriest!

EXPOSITORY TEXT SAMPLES

5) 11-year-old Neurotypical Child (Quality Score: 10)

Today I am wrighting a report on Buffolow Wild Wings. I you want first rate wings go there. The wings are delisous for all people, if you want spicy get the blazing sause, or you could get the teriki wings which is nice and sweet. There servece is great, and the waghters are realy nice too. Even the sides are first rate, you can get 3 soft pretsils or the awsome nachows. But the best side of them all is the ardachoke dip, it tasts like hevan. The preces are also good,

you can get a plate of 10 wings for 6.99. If you want some fun there you can watch football or get a tablet and play games or do trivia. All in all it is a realy fun place to go.

6) 9-year-old Neurotypical Child (Quality Score: 3)

ALL ABOUT ME: I like to do math and I like to play sports, all sow I like to run alot, I like art to ...

7) 11-year-old Child with ASD (Quality:10)

I like Transformers. My favorite charaters from greatest to least is Starscream, Grimlock and Soundwave. Starscream has Null rays that can disruspt the flow of energy in any character permanitly. He can also transform into a fighter jet and in jet mode he can shoot cluster bombs wich do the same thing as Null rays but they are temporary and have an explosive force. Grimlock has an extra powerfull blaster that can destoy anyone or anything with onely a few shots he can also transform into a T-Rex. In T-Rex mode he can shoot a flamthrower that is inside his mouth. Soundwave can use a normal blaster and he can deploy 6 different minicons they are Rumble, Frenzy, Ravage, Ratbat, Laserbeak and Buzzsaw he also has a shoulder canon. He transforms into a radio he can deploy minicons in both modes.

8) 9-Year Old Child ASD (Quality Score: 1)

I like to play blocks. I make a tower. I make a big tall tower. I made a tall tower. I make a pizza.

REFERENCE LIST

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed., text rev.). Washington, DC: Author.

American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author.

Assouline, S.G., Foley-Nicpon, M., & Dockery, L. (2012). Predicting the academic achievement of gifted students with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 42,* 1781-1789. doi:10.1007/s10803-011-1403-x

Baker, S., Gersten, R., & Graham, S. (2003). Teaching expressive writing to students with learning disabilities: Research-based applications and examples. *Journal of Learning Disabilities, 36,* 109-123.

Bamberg, M., & Damrad-Frye, R. (1991). On the ability to provide evaluative comments: Further explorations of children's narrative competencies. *Journal of Child Language, 18,* 689-710.

Baron-Cohen, S., Leslie, A.M., & Frith, U. (1985). Does the autistic child have a "theory of mind"? *Cognition, 21,* 37-46. doi:10.1016/0010-0277(85)90022-8

Barnes, J. L., Lombardo, M. V., Wheelwright, S., & Baron-Cohen, S. (2009). Moral dilemmas film task: A study of spontaneous narratives by individuals with autism spectrum conditions. *Autism Research, 2,* 148-156.

Berman, R. A. (2008). The psycholinguistics of developing text construction. *Journal of Child Language, 35,* 735-771. doi:10.1017/S03050009080087

Berman, R. A., & Katzenberger, I. (2004). Form and function in introducing narrative and expository texts: A developmental perspective. *Discourse Processes, 38,* 57-94. doi:10.1207/s15326950dp3801_3

Berman, R. A., & Nir-Sagiv, B. (2007). Comparing narrative and expository text construction across adolescence: A developmental paradox. *Discourse Processes, 43,* 79–120.

Berman, R., & Slobin, D. (1994). *Relating events in narrative: A cross-linguistic developmental study.* Hillsdale, NJ: Erlbaum

Berninger, V. W. (2015). *Interdisciplinary frameworks for schools: Best professional practices for serving the needs of all students.* Washington, DC: American Psychological Association. doi:10.1037/14437-002

Berninger, V. W., & Abbott, R. D. (2010). Listening comprehension, oral expression, reading comprehension, and written expression: Related yet unique language systems in grades 1, 3, 5, and 7. *Journal of Educational Psychology, 102*, 635-651. doi:10.1037/a0019319

Berninger, V., Abbott, R., Cook, C. R., & Nagy, W. (2017). Relationships of attention and executive functions to oral language, reading, and writing skills and systems in middle childhood and early adolescence. *Journal of Learning Disabilities, 50,* 434-449. 10.1177/0022219415617167

Berninger, V. W., Abbott, R. D., Whitaker, D., Sylvester, L., & Nolen, S. B. (1995). Integrating low- and high-level skills in instructional protocols for writing disabilities. *Learning Disability Quarterly*, 18, 293-309. doi:10.2307/1511235

Berninger V., & Niedo, J. (2014). Individualizing instruction for students with oral and written language difficulties. In: J. Mascolo, D. Flanagan, & V. Alfonso (Eds.), *Essentials of planning, selecting and tailoring intervention: Addressing the needs of unique learners* (pp. 231–264). New York: Wiley.

Bock, S. J., Borders, C. M., & Probst, K. M. (2016). Inclusion of students with autism spectrum disorders. In J. P. Bakken & F. E. Obiakor (Eds.), *General and special education inclusion in an age of change: Impact on students with disabilities* (pp. 49 – 64). West Yorkshire, England: Emerald Publishing.

Bölte, S., Westerwald, E., Holtmann, M., Freitag, C., & Poustka, F. (2011). Autistic traits and autism spectrum disorders: the clinical validity of two measures presuming a continuum of social communication skills. *Journal of Autism and Developmental Disorders, 41,* 66-72. doi:10.1007/s10803-010-1024-9.

Boucher, J. (2012). Research review: Structural language in autistics spectrum disorder-characteristics and causes. *Journal of Child Psychology and Psychiatry, 53*, 219-233. doi:10.1111/j.1469-7610.2011.02508.x

Brown, H. M. (2013). Academic achievement of children and adolescents with high-functioning Autism Spectrum Disorder with in-depth focus on written expression. *University of Western Ontario: Electronic Thesis and Dissertation Repository.*

Brown, H. M., Oram-Cardy, J., & Johnson, A. (2013). A meta-analysis of the reading comprehension skills of individuals on the autism spectrum. *Journal of Autism and Developmental Disorders, 43,* 932-955. doi:10.1007/s10803-012-1638-1.

Brown, H. M., & Klein, P. D. (2011). Writing, Asperger syndrome, and theory of mind. *Journal of Autism and Developmental Disorders, 41*, 1464-1474. doi:10.1007/s10803-010-1168-7

Brown, H. M., Johnson, A. M., Smyth, R., & Cardy, J. O. (2014). Exploring the persuasive writing skills of students with high-functioning autism spectrum disorder. *Research in Autism Spectrum Disorders, 8,* 1482-1499.

Bruner, J. & Feldman, C. (1993). Theories of mind and the problem of autism. In S. Baron-Cohen, H. Tager-Flusberg, & D.J. Cohen (Eds.), *Understanding other minds: Perspectives from autism.* Oxford: Oxford University Press.

Capps, L., Kehres, J., & Sigman, M. (1998). Conversational abilities among children with autism and children with developmental delays. *Autism, 2*, 325–44.

Cicchetti, D. V. (1994). Guidelines, criteria, and rules of thumb for evaluating normed and standardized assessment instruments in psychology. *Psychological Assessment, 6,* 284-290. doi:10.1037/1040-3590.6.4.284

Chan, A. S., Cheung, M., Han, Y. M. Y., Sze, S. L., Leung, W. W., Man, H. S., & To, C. Y. (2009). Executive function deficits and neural discordance in children with Autism Spectrum Disorders. *Clinical Neuropsychology, 120,* 1107-1115. doi: 10.1016/j.clinph.2009.04.002

Chall, J. (1983). *Stages of reading development.* New York: McGraw Hill.

Christensen, D. L., Baio, J., Braun, K. V., Bilder, D., Charles, J., Constantino, J. N., Daniels, J... & Yeargin-Allsopp. (2016). Prevalence and characteristics of autism spectrum disorder among children aged 8years—autism and developmental disabilities monitoring network, 11 sites, United States, 2012. Morbidity and Mortality Weekly Report: Surveillance Summaries 65: 1–23.

Colle, L., Baron-Cohen, S., Wheelwright, S., & van der Lely, H. K. J. (2008). Narrative discourse in adults with high-functioning autism or Asperger syndrome. *Journal of Autism and Developmental Disorders, 38,* 28-40.

College Entrance Examination Board. (2004). Writing: A ticket to work… or a ticket out. *National commission on writing for America's families, schools, and colleges*, 1- 40. Retrieved from http://www.collegeboard.com/prod_downloads/writingcom/writing-ticket-to-work.pdf

Constantino, J. N., & Gruber, C. P. (2012). *Social Responsiveness Scale, Second Edition*. Los Angeles, CA: Western Psychological Services.

Cragg, L., & Nation, K. (2006). Exploring written narrative in children with poor reading comprehension. *Educational Psychology: An International Journal of Experimental Educational Psychology, 26*, 55-72. doi:10.1080/01443410500340991

Crespi, B., Leach, E., Dinsdale, N., Mokkonen, M., & Hurd, P. (2016). Imagination in human social cognition, autism, and psychotic-affective conditions. *Cognition, 150*, 181-199. doi:10.1016/j.cognition.2016.02.001.

Delano, M. E. (2007). Improving written language performance of adolescents with Asperger syndrome. *Journal of Applied Behavioral Analysis, 40,* 345-351. doi:10.1901/jaba.2007.50-06

DeCoste, D. (2005). *Assistive technology assessment: Developing a written productivity profile.* Volvo, IL: Don Johnson Incorporated.

Dockrell, J. E., Ricketts, J., Charman, T., & Lindsay, G. (2014) Exploring writing products in students with language impairments and autism spectrum disorders. *Learning and Instruction, 32,* 81-90. doi:10.1016/j.learninstruc.2014.01.008

Dowell, L. R., Mahone, E. M., & Mostofsky, S. H. (2009). Associations of postural knowledge and basic motor skill with dyspraxia in autism: Implication for abnormalities in distributed connectivity and motor learning. *Neuropsychology, 23*, 563–570. doi:10.1037/a0015640

Drijbooms, E., Groen, M.A., & Verhoeven, L. (2015). The contribution of executive functions to narrative writing in fourth grade children. *Reading and Writing, 28*, 989-1011. doi:10.1007/s11145-015-9558-z

Drijbooms, E., Groen, M.A., & Verhoeven, L. (2017). Children's use of evaluative devices in spoken and written narratives. *Journal of Child Language, 44*, 767-794. doi:10.1017/S0305000916000234

Foley-Nicpon, M., Assouline, S. G., & Stinson, R. D. (2012). Cognitive and academic distinctions between gifted students with autism and Asperger syndrome. *Gifted Child Quarterly, 56*, 77–89. doi:10.1177/0016986211433199

Frith, U. (2001). Mind blindness and the brain in autism. *Neuron, 32*, 969-979. doi:10.1016/S0896-6273(01)00552-9

Fuentes, C. T., Mostofsky, S. H., & Bastian, A. J. (2009). Children with autism show specific handwriting impairments. *Neurology, 73*, 1532-1537. doi:10.1212/ WNL. 0b013e3181c0d48c

Gatley, S. E. (2008). Facilitating reading comprehension for students on the autism spectrum. *Teaching Exceptional Children, 40*, 40-45.

Gibbs, J., Appleton, J., Appleton, R. (2007). Dyspraxia or developmental coordination disorder? Unravelling the enigma. *Archives of Disease in Childhood, 92*, 534–539. doi:10.1136/adc.2005.088054

Gioia, G. A., Isquith, P, Guy, S. C., & Kenworthy, L. (2015). *Behavior rating inventory of executive function, second edition.* Odessa, FL: Psychological Assessment Resources.

Gioia, G. A., & Isquith, P. K. (2004). Ecological assessment of executive function in traumatic brain injury. *Neuropsychology, 25,* 135-158.

Geurts, H.M., Verté, S., Oosterlaan, J., Roeyers, H., & Sergeant, J.A. (2004). How specific are executive functioning deficits in attention-deficit hyperactivity disorder and autism? *Journal of Child Psychology and Psychiatry, 45*, 836-854. doi: 10.1111/j.1469-7610.2004.00276.x

Goddard, L., Dritschel, B., Robinson, S., & Howlin, P. (2014). Development of autobiographical memory in children with autism spectrum disorders: Deficits, gains, and predictors of performance. *Developmental Psychopathology, 26*, 215-228.

Graham, S. (2006). Strategy instruction and the teaching of writing: A meta-analysis. In C. A. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research* (pp. 187-207). New York: Guilford Press.

Graham, S., Berninger, V., & Abbott, R. (2012). Are attitudes toward writing and reading separable constructs? A study with primary grade children. *Reading and Writing Quarterly, 28*, 51-69. doi:10.1080/10573569.2012.632732

Graham, S., Berninger, V., Weintraub, N., & Schafer, W. (1998). Development of handwriting speed and legibility in grades 1–9. *The Journal of Educational Research, 92,* 42-52. doi:10.1080/00220679809597574

Graham, S., Berninger, V. W., Abbott, R. D., Abbott, S. P., & Whitaker, D. (1997). Role of mechanics in composing of elementary school students: A new methodological approach. *Journal of Educational Psychology, 89*, 170-182.

Graham, S., Harris, K. R., & Chorzempa, B. F. (2002). Contribution of spelling instruction to the spelling, writing, and reading of poor spellers. *Journal of Educational Psychology, 94*, 669-686. doi:10.1037//0022-0663.94.4.669

Graham, S., Harris, K. R., & Olinghouse, N. (2007). Addressing executive function problems in writing. In L. Meltzer (Ed.), *Executive function in education: From theory to practice* (pp. 216–236). New York: Guilford.

Graham, S., McKeown, D., Kiuhara, D., & Harris, S. (2012). A meta-analysis of writing instruction for students in the elementary grades. *Journal of Educational Psychology, 104*, 879-896. doi:10.1037/a0029185

Graham, S., & Perin, D. (2007). A meta-analysis of writing instruction for adolescent students. *Journal of Educational Psychology, 99,* 445–476.

Graham, S., & Weintraub, N. (1996). A review of handwriting research: Progress and prospects from 1980 to 1994. *Educational Psychology Review, 8,* 8–87.

Graesser, A. C., & Goodman, S. M. (1985). How to construct conceptual graph structures. In B. Britton & J. B. Black (Eds.), *Understanding expository text.* Hillsdale, NJ: Erlbaum.

Griswold, D. E., Barnhill, G. P., Smith Myles, B., Hagiwara, T., & Simpson, R. L. (2002). Asperger syndrome and academic achievement. *Focus on Autism and Other Developmental Disabilities, 17,* 94-102. doi:10.1177/10883576020170020401

Geurts, H. M., Verté, S., Oosterlaan, J., Roeyers, H., & Sergeant, J. A. (2004). How specific are executive function deficits in attention deficit hyperactivity disorder and autism? *Journal of Child Psychology and Psychiatry, 45*, 836–854.

Hamstra-Bletz, L., & Blote, A. W. (1990). A longitudinal study on dysgraphic handwriting in primary school. *Journal of Learning Disabilities, 26*, 689-699. doi:10.1177/002221949302601007

Happé, F. (1991). The autobiographical writings of three Asperger syndrome adults: Problems with interpretation and implications for theory. In U. Frith (Ed.), *Autism and Asperger syndrome* (pp. 207-242). Cambridge, UK: Cambridge University Press.

Happé, F. (1994). An advanced test of theory of mind: Understanding of story characters' thoughts and feelings by able autistic, mentally handicapped, and normal children and adults. *Journal of Autism and Developmental Disorders, 24,* 129-154.

Harding, S. (2009). Successful inclusion models for students with disabilities require strong site leadership: Autism and behavioral disorders create many challenges for the learning environment. *The International Journal of Learning, 16,* 91-100.

Hendricks, D. R., & Wehman, P. (2009). Transition from school to adulthood for youth with autism spectrum disorders: Review and recommendations. *Focus on Autism and Other Developmental Disabilities, 24,* 77-88. doi:10.1177/108835760832982

Heaton, R.K., Cheluen, G., Talley, J.L., Kay, G.G., & Curtiss, G. (1993). *Wisconsin Card Sorting Test.* Lutz: Psychological Assessment Resources, Inc.

Hidi, S. E., & McLaren, J. A. (1991). Motivational factors and writing: The role of topic interestingness. *European Journal of Psychology of Education, 6,* 187-197.

Hooper, S.R., Swartz, C.W., Wakely, M.B., de Kruif, R.E.L., & Montgomery, J. (2002). Executive functions in elementary school children with and without problems in written expression. *Journal of Learning Disabilities, 35*, 57-68. doi:10.1177/002221940203500105

Hudson, J.A. & Shapiro, L.R. (1991) From knowing to telling: The development of children's scripts, stories and personal narratives. In A. McCabe & C. Peterson (Eds.) *Developing narrative structure.* Hillsdale, N.J., Lawrence Erlbaum Associates, Publishers.

Individuals with Disabilities Education Act, 20 U.S.C. § 1400 (2004).

James, K. H., Jao, R. & Berninger, J. (2016) The development of multileveled writing systems of the brain: Brain lessons for writing instruction. In C. A. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research, 2nd* (pp. 116–129). New York: Guilford Press.

Jisa, H., Reilly, J.S., Verhoeven, L., Baruch, E., & Rosado, E. (2002). Passive voice constructions in written texts: A crosslinguistic developmental study. *Written Language and Literacy, 5,* 163-182.

Jones, D., & Christensen, C. A. (1999). Relationship between automaticity in handwriting and student's ability to generate written text. *Journal of Educational Psychology, 91*, 44- 49. doi:10.1037/0022-0663.91.1.44

Karmiloff-Smith A. (1983). Language development as a problem-solving process. *Papers and Reports on Child Language Development, 22*, 1–22.

Kenworthy, L., Yerys, B. E., Anthony, L. G., & Wallace, G. L. (2008). Understanding executive control in autism spectrum disorders in the lab and in the real world. *Neuropsychology Review, 18,* 320-338. doi:10.1007/s11065-008-9077-7

Kongs, S. K., Thompson, L. L., Iverson, G. L., & Heaton, R. K. (2000). *Wisconsin Card Sorting Test – 64 Card Version*. Lutz, Fl: Psychological Assessment Resources, Inc.

Kroenke, C. (2015). *Comparison of conversation and narrative language abilities in children with autism: Diagnostic and therapeutic considerations* (Unpublished doctoral dissertation). University of Wisconsin-Milwaukee, Milwaukee, Wisconsin.

Kushki, A., Chau, T., & Anagnostou, E. (2011). Handwriting difficulties in children with autism spectrum disorders: A scoping review. *Journal of Autism and Developmental Disorders, 41,* 1706-1716. doi:10.1007/s10803-011-1206-0

Labov, W. (1982). Speech actions and reactions in personal narrative. In D. Tannen (Ed.), *Analyzing discourse: Text and talk* (pp. 219-247). Georgetown University Press.

Labov, W., & Waletzky, J. (1967). Narrative analysis. In J. Helm (Ed.), *Essays on the verbal and visual arts* (pp. 12 -44). Seattle, WA: Washington Press.

Lind, S. E. (2010). Memory and the self in autism: A review and theoretical framework. *Autism, 14*, 430-456. doi:10.1177/1362361309358700

Losh, M., & Capps, L. (2003). Narrative ability in high-functioning children with autism or Asperger's syndrome. J*ournal of Autism and Developmental Disorders, 33,* 239-251

Loveland, K. A., McEvoy, R. E., & Tunali, B. (1990). Narrative story telling in autism and Down's syndrome. *British Journal of Developmental Psychology, 8,* 9 -23. doi:10.1111/j.2044-835X.1990.tb00818.x

Loveland, K. & Tunali, B. (1993). Narrative language in autism and the theory of mind hypothesis: A wider perspective. In S. Baron-Cohen, H. Tager-Flusberg, & D. J. Cohen (Eds.), *Understanding other minds: Perspectives from autism.* Oxford: Oxford University Press.

Mackie, C. J., Dockrell, J., & Lindsay, G. (2013). An evaluation of the written texts of children with SLI: the contributions of oral language, reading and phonological short-term memory. *Reading and Writing, 26*, 865-888. doi:10.1007/s11145-012-9396-1

Magnifico, A. M. (2010). Writing for whom? Cognition, motivation, and a writer's audience. *Educational Psychologist, 45*, 167 -184. doi:10.1080/00461520.2010.493470

Mayes, S. D., & Calhoun, S. L. (2003). Ability profiles in children with autism. *Autism, 6*, 65–80.

Mayes, S. D., & Calhoun, S. L. (2006). Frequency of reading, math, and writing disabilities in children with clinical disorders. *Learning and Individual Differences, 16*, 145–157.

Mayes, S. D., & Calhoun, S. L. (2007). Learning, attention, writing, and processing speed in typical children and children with ADHD, autism, anxiety, depression, and oppositional-defiant disorder. *Child Neuropsychology, 13*, 469-493.

Mayes, S. D., & Calhoun, S. L. (2008). WISC-IV and WIAT-II profiles in children with high-functioning autism. *Journal of Autism and Developmental Disorders, 38*, 428–439.

Mckeough, A., Genereux, R., & Jeary, J. (2006). Structure, content, and language usage: How do exceptional and average storywriters differ? *High Ability Studies, 17*, 203-223. doi:10.1080/1359813060112143

McCutchen, D. (1986). Domain knowledge and linguistic knowledge in the development of writing ability. *Journal of Memory and Language, 25*, 431-444. doi:10.1016/0749596X(86)90036-7

Mercer, C. D., & Mercer, A. R. (2005). *Teaching students with learning problems* (7th ed.). Upper Saddle River, NJ: Pearson.

Miller, C. A. (2006). Developmental relationships between language and theory of mind. *American Journal of Speech-Language Pathology, 15*, 142-154. doi:1058-0360/06/1502-0142

Ming, X., Brimacombe, M., & Wagner, G. C. (2007). Prevalence of motor impairment in autism spectrum disorders. *Brain and Development, 29*, 565–570. doi:10.1016/j.braindev.2007.03.002

Moskal, B. M. (2000). Scoring rubrics? What, when, and how? *Practical Assessment, Research, and Evaluation, 7*. Available online: http://PAREonline.net/getvn.asp?v=7&n=3.

Nader-Grosbois, N., & Day, J. M. (2011). Emotional cognition: Theory of mind and face recognition. In J. L. Matson & P. Sturmey (Eds.), *International handbook of autism and pervasive developmental disorders* (pp.127-157). New York: Springer.

Nippold, M. A., Ward-Lonergan, J. M., & Fanning, J. L. (2005). Persuasive writing in children, adolescents, and adults: A study of syntactic, semantic, and pragmatic development. *Language, Speech, and Hearing Services in School, 36*, 125-138.

Olinghouse, N. G., Graham, S., & Gillespie, A. (2015). The Relationship of discourse and topic knowledge to fifth graders' writing performance. *Journal of Educational Psychology, 107*, 391-406. doi:10.1037/a0037549

Ozonoff, S., & Jensen, J. (1999). Brief report: specific executive function profiles in three neurodevelopmental disorders. *Journal of Autism and Developmental Disorders, 29,* 171-177.

Perner, J., Frith, U., Leslie, A. M., & Leekam, S. R. (1989). Exploration of the autistic child's theory of mind: Knowledge, belief, and communication. *Child Development, 60,* 688-700.

Peterson, C., & McCabe, A. (1983). *Developmental psycholinguistics: Three ways of looking at a child's narrative*. New York: Plenum.

Randi, J., Newman, T., & Grigorenko, E. L. (2010). Teaching children with autism to read for meaning: challenges and possibilities. *Journal of Autism and Developmental Disorders 40*: 890–902. doi:10.1007/s10803-010-0938-6

Ravid, D. (2004). Emergence of linguistic complexity in written expository texts: Evidence from later language acquisition. In D. Ravid & H. Bat-Zeev Shyldkrot (Eds.), *Perspectives on language and language development* (pp. 337-355). Dordrecht: Kluwer.

Ravid, D., & Berman, R. A. (2010). Developing noun phrase complexity across adolescence: a text-embedded analysis. *First Language, 30*, 1–29. doi:10.1177/0142723709350531

Reilly, J. (1992). How to tell a good story: The intersection of language and affect in children's narratives. *Journal of Narrative and Life History, 2*, 355–377.

Saddler, B., & Asaro-Saddler, K. (2013). Response to Intervention in writing: A suggested framework for screening, intervention, and progress monitoring. *Reading and Writing Quarterly, 29*, 1, 20-43. doi:10.1080/10573569.2013.741945

Sattler, J. M. (2001). *Assessment of children: Cognitive applications, 4th ed.* Austin, TX: Pro-Ed, Inc.

Schopler, E., & Van Bourgondien, M. E. (2010). *Childhood Autism Rating Scale, Second Edition*. Los Angeles, CA: Western Psychological Services.

Schleppegrell, M. J. (2004). *The language of schooling: A functional linguistic approach.* Mahwah, NJ: Lawrence Erlbaum Associates.

Scott, C. M. (2009). Language-based assessment of written expression. In G. A. Troia (Ed.), *Instruction and assessment for struggling writers: Evidence-based practices* (pp. 358-385). New York: Guilford Press.

Scott, C. M. (2004). Syntactic ability in children and adolescents with language and learning disabilities. In R. A. Berman (Ed.), *Language development across childhood and adolescence* (pp. 111-133). Amsterdam: John Benjamins.

Scott, C. M., & Windsor, J. (2000). General language performance measures in spoken and written narrative and expository discourse of school-age children with language learning disabilities. *Journal of Speech, Language, and Hearing Research, 43*, 324-339. doi:10.1044/jslhr.4302.324

Scott, C. M. (2010). Assessing expository texts produced by school-age children and adolescents. In M.A. Nippold & C. M. Scott (Eds.), *Expository discourse in children, adolescents, and adults* (pp. 191- 213). New York: Psychology Press.

Schaefer-Whitby, P. J., & Richmond-Mancil, G. (2009). Academic achievement profiles of children with high functioning autism and Asperger syndrome: A review of the literature. *Education and Training in Developmental Disabilities, 44*, 551-560.

Shanahan, T. (2006). Relations among oral language, reading, and writing development. In C. A. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research* (pp. 171-183). New York, NY: Guilford Press.

Siverston, K. (2010). *Stories from the spectrum: How special interest areas affect writing quality for students with autism spectrum disorders* (Unpublished doctoral dissertation). University of Minnesota-Duluth, Minnesota, Duluth.

Stein, N., & Glen, C., (1979). An analysis of story comprehension in elementary school children. In R. O. Freedle (Ed.), *New directions in discourse processing* (pp. 53 -120). Hillsdale, NJ: Ablex, Inc.

Sullivan, K., Zaitchik, D., & Tager-Flusberg, H. (1994). Preschoolers can attribute second-order beliefs. *Developmental Psychology, 30,* 395-402. doi:10.1037/0012-1649.30.3.395

Tager-Flusberg, H. (2007). Language and understanding minds: Connections in autism. In S. Baron-Cohen, H. Tager-Flusberg, & D. J. Cohen (Eds.), Understanding other minds: Perspectives from autism and developmental cognitive neuroscience, Second Edition. Oxford: Oxford University Press.

Tager-Flusberg, H., & Anderson, M. (1991). The development of contingent discourse ability in autistic children. *Journal of Child Psychology and Psychiatry, 32*, 1123-1134.

Tager-Flusberg, H. & Sullivan, K. (1995). Attributing mental states to story characters: A comparison of narratives produced by autistic and mentally retarded individuals. *Applied Psycholinguistics, 16*, 241-256. doi:10.1017/S0142716400007281

Troia, G. A. (2011). *Instruction and assessment for struggling writers: Evidence-based practices (Challenges in language and literacy)*. New York: Guilford Press.

van den Bergh, S. F. W., Sheeren, A. M., Begeer, S., Koot, H. M., & Geurts, H. M. (2014). Age related differences of executive functioning in everyday life of children and adolescents in the Autism Spectrum. *Journal of Autism and Developmental Disorders*. doi:10.1007/s/10803-014-20714

Wagner, R., Nettelbladt, U., Sahlén, B., & Niholm, C. (2000). Conversation versus narration in children with language impairment. *International Journal of Language & Communication Disorders 35*, 83-93.

Wechsler, D. (2001). *Wechsler Individual Achievement Test, Second Edition.* San Antonio, TX: Pearson Assessments.

Wechsler, D. (2011). *Wechsler Abbreviated Scale of Intelligence, Second Edition*. San Antonio, TX: Pearson Assessments.

Welsh, M. (1991). Rule-guided behavior and self-monitoring on the tower of Hanoi disk-transfer task. *Cognitive Development, 6*, 59-76.

Wiig, E. H., Semel, E., & Secord, W. A. (2013). *Children's Evaluation of Language Fundamentals, Fifth Edition.* San Antonio, TX: Pearson Assessments.

Winsler, A., Abar, B., Feder, M. A., Schunn, C. D., & Rubio, D. A. (2007). Private speech and executive functioning among high- functioning children with autistic spectrum disorders. *Journal of Autism and Developmental Disorders, 37,* 1617–1635.

White, S., Hill, E., Happé, F., & Frith, U. (2009). Revisiting the Strange Stories: Revealing mentalizing impairments in autism. *Child Development, 80*, 1097-1117. doi:10.1111/j.1467-8624.2009.01319.x

Woodcock, R. W., McGrew, K. S., & Mather, N. (2001). *Woodcock Johnson III Test of Cognitive Abilities.* Rolling Meadows, IL: Riverside Publishing.

Zajic, M. C., McIntyre, N., Swain-Lerro, L., Novotny, S., Oswald, T., & Mundy, P. (2016). Attention and written expression in school-age, high-functioning children with autism spectrum disorders. *Autism*, advanced online publication, 1-14. doi:10.1177/1362361316675121

Ziviani, J. M., & Wallen, M. (2006). The development of graphomotor skills. In A. Henderson & C. Pehoski (Ed.), *Hand function in the child: foundations for remediation, 2nd edition* (pp. 217-236). Philadelphia, USA: Mosby Elsevier.

VITA

Elizabeth Hilvert was born and raised in Cincinnati, Ohio. Before attending Loyola University Chicago, she attended Saint Louis University, where she earned a Bachelor of Arts in Psychology in 2012, graduating cum laude.

While at Loyola, Elizabeth was awarded the Child and Family Assistantship, as well as the Arthur J. Schmitt Dissertation Fellowship in Leadership and Service, and was selected as a graduate mentor for the Research Mentoring Program. Elizabeth has also won the Jesuit Award and the Best Quantitative Paper Award at the Graduate Research Symposium in 2016 and 2017, respectively.

Currently, Elizabeth is a post-doctoral fellow at the Waisman Center at the University of Wisconsin-Madison.