
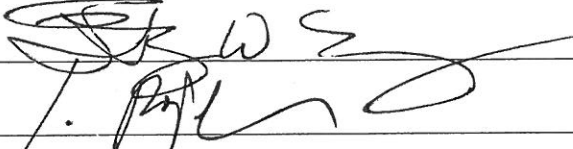
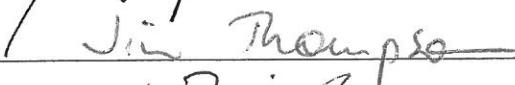




PARENT-CHILD INTERACTION, SCAFFOLDING, AND PRIVATE SPEECH
AMONG CHILDREN WITH ADHD OR HIGH FUNCTIONING AUTISM

by

Rebekah LaRocque
A Thesis
Submitted to the
Graduate Faculty
of
George Mason University
in Partial Fulfillment of
The Requirements for the Degree
of
Master of Arts
Psychology

Committee:

	Director
	
	Department Chairperson
	Dean, College of Humanities and Social Sciences
Date: 	Fall Semester 2012 George Mason University Fairfax, VA

Parent-Child Interaction, Scaffolding, and Private Speech Among Children with ADHD
or High Functioning Autism

A thesis submitted in partial fulfillment of the requirements for the degree of Master of
Arts at George Mason University

By

Rebekah LaRocque
Bachelor of Arts
University of Rochester, 2009

Director: Adam Winsler, Professor
Department of Psychology

Fall Semester 2012
George Mason University
Fairfax, VA

Copyright 2012 Rebekah LaRocque
All Rights Reserved

DEDICATION

This is dedicated to my amazing support network of loving friends and family who have always helped and encouraged me through the good times and the bad.

ACKNOWLEDGEMENTS

I would like to thank my parents and the many friends who continue to stand by my side through the many ups and downs of my life. Special thanks to my adviser, Dr. Adam Winsler, for always having my back and providing the guidance and support I needed to accomplish my goals.

TABLE OF CONTENTS

	Page
List of Tables.....	vi
List of Figures.....	vii
Abstract.....	viii
Introduction.....	1
Method.....	12
Results.....	19
Discussion.....	38
Appendix.....	44
List of References.....	47

LIST OF TABLES

	Page
Table	
Table 1	12
Table 2	20
Table 3	27
Table 4	32

LIST OF FIGURES

Figure	Page
Figure 1	23
Figure 2	24
Figure 3	26
Figure 4	29
Figure 5	30

ABSTRACT

PARENT-CHILD INTERACTION, SCAFFOLDING, AND PRIVATE SPEECH AMONG CHILDREN WITH ADHD OR HIGH FUNCTIONING AUTISM

Rebekah LaRocque, MA

George Mason University, 2012

Thesis Director: Dr. Adam Winsler

Children with autistic spectrum disorders (ASD) have difficulty self-regulating cognition and behavior, revealing an underlying executive functioning problem. These deficits may disappear when children with ASD use private speech. The goal of this study was to examine the role of parent-child interaction in the private speech use and executive functioning of children with high-functioning ASD. Eighty-two children (18 females) aged 7 to 18 diagnosed with high functioning ASD ($n = 33$) or Attention Deficit Hyperactivity Disorder (ADHD; $n = 21$), and matched controls ($n = 28$) completed the Tower of Hanoi task, first with the assistance of their parent, and then, again, individually. Child private speech use and performance were assessed during the dyad and individual sessions. The overall quality of parental scaffolding was rated. Results suggested that parents of ASD children engaged in lower quality scaffolding than controls. Child individual executive performance for all groups improves when parents

talk less and children talk more in the dyad. ASD children were less likely than controls to use private speech (or any speech during the dyad), but when they did, it was similar to the other groups. The findings indicate that child speech should be encouraged during joint activities because it improves their performance later on when completing the task alone. Interventions could focus on using private speech as a tool with other techniques to improve executive functioning skills of children with high-functioning autism.

INTRODUCTION

Children with autistic spectrum disorders (ASD) display impairments in social interactions and communication, and exhibit repetitive behaviors and restricted interests (American Psychiatric Association, DSM-IV-TR, 2000). These impairments and behaviors result in difficulties in organization, planning, set shifting, and inhibiting inappropriate language use and behavior. More specifically, ASD is characterized as an executive functioning problem of higher-order psychological processes (Hill, 2004; Russell, 1997). A core feature of ASD is difficulty in the self-regulation of cognition and behavior, particularly while engaging in goal-directed behavior. When asked to complete executive functioning tasks, self-regulatory impairments of children with ASD become distinguishable from normally developing children (Winsler, Abar, Feder, Schunn, & Rubio, 2007). However, executive functioning deficits may disappear when children with ASD are able to self-regulate through overt verbalizations or private speech (e.g., Winsler et al., 2007).

Private Speech and Self-Regulation in Normally Developing Children

Children use language as a tool to guide their thinking and behavior. During activities such as problem-solving tasks and play, children are known to exhibit private speech (Diaz & Berk, 1992), which is commonly defined as audible, overt speech that is

not directed toward another person (Winsler, 2009). In contrast, inner speech is characterized as internal, verbal thought that occurs completely inside the child's head. Children use private speech most often during difficult tasks because they are attempting to self-regulate by verbally planning and organizing their thoughts (Winsler et al., 2007). Over time, the use of overt private speech declines because children internalize language (inner speech), evidencing greater self-regulatory skills. Specifically, while completing problem-solving tasks, typically developing children tend to decrease their usage of overt private speech and increase their usage of partially internalized speech and inner speech over time (Winsler, 2009).

Social Origins of Private Speech: The Vygotskian Perspective

Vygotsky's (1987) widely accepted socio-cultural theory of development proposes the idea that executive functioning originates through social interactions with parents that become internalized ontogenetically. That is, children take language from their social world and use it to guide language in their mental world, leading to a reorganization of psychological processes and self-regulatory behaviors. Vygotsky's theory suggests that private speech is a mediating step toward internalizing language, revealing private speech as an important indicator of, and tool for, self-regulation (Winsler, 2009). Consistent with Vygotsky's theory, research has found that children increase their use of internalized speech through private speech, leading to cognitive competence (Berk & Spuhl, 1995). Inner speech also plays a key role in children's development (Vygotsky, 1962). According to Vygotsky (1987), inner speech also develops gradually through the internalization of social interactions, with language

(private speech) serving a mediating role. That is, children use private speech as a tool for internalizing language from social interactions to guide individual learning.

Parent-Child Interactions of Normally Developing Children

Evidence of the social influence on private speech and self-regulation suggests that parents can encourage or discourage its use through scaffolding during joint tasks completed with their children (Winsler, 1995; Winsler, Diaz, McCarthy, Atencio, & Chabay, 1999). Scaffolding refers to a sensitive, autonomy-supportive style of assisting children on collaborative problem solving tasks (Berk & Winsler, 1995). When parents provide high-quality scaffolding assistance during joint tasks, children use more private speech (Berk & Spuhl, 1995).

Landry, Miller-Loncar, Smith, and Swank (2002) conducted a study supporting the idea that parents scaffold children's self-regulation through language. These investigators examined mother-child free play sessions at ages three, four, and six, and recorded mother's use of scaffolding language. Additionally, children's language competence was measured at age four and children's executive functioning was measured at age six. Landry et al. (2002) found that parent's use of scaffolding language during joint tasks was positively predictive of children's executive functioning at age six, and this was mediated by children's language competence at age four.

Private Speech and Self-Regulation of Children with ADHD

Like ASD, Attention Deficit Hyperactivity Disorder (ADHD) is a disorder associated with deficits in cognitive and behavioral control. Children with ADHD display symptoms of inattention, impulsivity, and hyperactivity that interfere in social settings, at

home, and at school (American Psychiatric Association, DSM-IV-TR, 2000). Like ASD, ADHD is also characterized as a self-regulatory problem in which children have difficulty planning, organizing, and controlling/inhibiting disruptive behaviors (eg. Schroeder & Kelley, 2009; Stevens, Quittner, Zuckerman, & Moore, 2002). As compared to typically developing children, those with ADHD tend to use more private speech (both task-relevant and task-irrelevant) during tasks as a result of their difficulty regulating task performance (Corkum, Humphries, Mullane, & Theriault, 2008; Winsler et al., 1999). This inability and the cognitive and behavioral deficits associated with ADHD indicate a delay in the internalization of private speech. Age-related declines in externalized private speech use and increases in partially internalized speech seen among typically developing children, but not in children with ADHD, also provide evidence of an internalization delay in children with ADHD (Winsler, 1998). Whereas typically developing children tend to use more partially internalized forms of private speech (inaudible muttering and whispers), children with ADHD tend to use more externalized forms of private speech (Winsler, 2009).

Parent-Child Interactions Among Children with ADHD

As mentioned above, research has provided evidence of the social origins of private speech and self-regulation (e.g., Berk & Spuhl, 1995; Vygotsky, 1987). Parent-child interactions are important to consider because of the bidirectional influence between parent and child. This is especially important for children with behavior problems, such as ADHD. Parents of children with ADHD tend to be more controlling and negative with their children than parents of comparison children when completing

joint problem solving tasks (Winsler et al., 1999). More specifically, parents of children with ADHD exhibit more negative control strategies and poor scaffolding interactions as compared to parents of controls. Winsler et al. (1999) investigated the relations among mother-child interactions, children's use of private speech, and performance on a puzzle task in preschool children with and without behavior problems. Evidence from individual sessions indicated that children with behavior problems were more likely to use task-relevant private speech than matched controls, with those using more partially internalized private speech showing increases in task performance. Consistent with other findings, dyadic sessions were characterized by more negative control and other-regulation and less praise and mother withdrawal of control over time for children with behavior problems (Campbell, Pierce, March, Ewing, & Szumowski, 1994; Gardner, 1994) and children with ADHD (Anderson, Hinshaw, & Simmel, 1994; Winsler, 1998) as compared to control children. For children with behavior problems, task performance was not associated with verbal skills or private speech use. Winsler (1998) examined the relations between parent-child interaction, private speech quality, and task performance in a sample of boys with ADHD and matched controls. Unlike typically developing peers, boys with ADHD were less compliant and engaged in more task-irrelevant (and for older boys, more task-relevant) and less partially internalized private speech use than control boys (Winsler, 1998).

Given that both ADHD and ASD are self-regulatory problems, and less sensitive and negative interactions are characteristic of mothers of children with ADHD, it may be that mothers of ASD would interact similarly with their children. However, this may not

be the case. A study investigating social communication and compliance patterns of interactions between 63 mothers and their children with mild developmental delays (aged 4 to 6.5) found that mothers behave in highly sensitive ways to support the development of their developmentally delayed child (Guralnick, Neville, Hammond, & Connor, 2008). This indicates that, perhaps, parents of children with ASD are similarly sensitive when interacting with their children. To date, there have been no studies that examined the quality of parent scaffolding in children with ASD.

Private Speech and Self-Regulation in Children with ASD

I have described the use of private speech in ADHD and normally developing children, but what is known about private speech usage among children with ASD? To date, there is only one study that examined overt private speech use in children with ASD (Winsler et al., 2007), and a few studies that investigated inner speech use in children with ASD (Holland & Low, 2009; Lidstone, Fernyhough, Meins, & Whitehouse, 2009; Wallace, Silvers, Martin, & Kenworthy, 2009; Whitehouse, Mayberry, & Durkin, 2006; Williams, Happe, & Jarrold, 2008; Williams & Jarrold, 2010).

Winsler et al.'s (2007) study investigated overt private speech use among children with high-functioning autism using two computer-administered executive functioning tasks (Wisconsin Card Sort Task and Building Sticks Task) that were completed during individual sessions. The authors found that children with autism were just as likely as controls to use overt task-relevant private speech, sometimes more often during difficult parts of the task, when performing problem-solving tasks. Children with autism were more likely than controls to increase task performance when using private speech,

suggesting that such verbal mediation during executive functioning tasks helps these children to regulate their performance. The authors suggest that task-relevant private speech allows children with autism to somewhat normalize their performance, as compared to controls.

There are mixed findings in regards to inner speech use among children with ASD. Some studies have hypothesized that children with ASD do not have inner speech impairments, thus children with ASD use inner speech similarly to typically developing children (Williams et al., 2008). Williams and colleagues (2008) used a short-term memory recall task to investigate whether children with ASD spontaneously use inner speech to mediate their recall from short-term memory, or whether they rely on the use of visuo-spatial representations (as suggested by Whitehouse et al., 2006). Verbal and non-verbal abilities were also assessed. Williams et al. (2008) found that children with ASD used inner speech similar to children without ASD of comparable mental age, indicating that their ability to engage in inner speech is not impaired. Thus, children with autism were just as likely to use inner speech as children without ASD.

Contrastively, other studies hypothesize that children with ASD do not use inner speech to self-regulate task performance (Holland & Low, 2009; Wallace et al., 2009; Whitehouse et al., 2006). Whitehouse et al. (2006) conducted three experiments investigating potential inner speech deficits of children with autism by using verbal recall and encoding tasks in the first two experiments and a task-switching paradigm in the third experiment. The results of the first two experiments indicated that children with autism are less likely than controls to use inner speech when asked to remember pictures. In the

third, task-switching experiment, articulatory suppression, a method intended to block inner speech use through irrelevant, repetitive articulation, was introduced to both the typically developing controls and autistic groups. Articulatory suppression did not affect task-switching performance for the autistic group (but did for the typical children), indicating that unlike typically developing children, those with autism do not use inner speech when alternating tasks. Similarly, Holland and Low (2009) also used articulatory suppression to examine executive control in children with autism and typically developing peers, finding that children with autism self-regulated their task-switching performance not through inner speech use, but through visuospatial working memory resources, also indicating inner speech impairments. In addition, Wallace et al. (2009) also found that children with autism do not appear to use inner speech to self-regulate during executive functioning tasks.

Extending the findings of Whitehouse et al.'s (2006) third experiment, Lidstone et al. (2009) reanalyzed the data, but created subgroups for children with and without poor verbal skills. The authors hypothesized that both the combination of poor verbal language skills (i.e., those with greater nonverbal skills in relation to verbal skills – $NV > V$) and a diagnosis of autism contributed most to inner speech impairment. Results indicated that articulatory suppression interfered with inner speech use for children with autism, but not for matched controls. As compared to the autistic subgroup with equal nonverbal and verbal skills, the $NV > V$ group showed no interference in inner speech use, indicating that this particular subgroup does have inner speech impairments. Consistent with the authors' hypothesis, this finding reveals that both a lack of verbal skills and a diagnosis

of autism produce the most profound inner speech impairments in children with autism. Interestingly, this combination did not result in declines in performance. In fact, the NV > V group performed just as well as the control group. The authors suggest that the finding of inner speech impairment of only the NV > V group might explain the contradictory evidence found in recent studies on inner speech use in autism (e.g., Whitehouse et al., 2006; Williams et al., 2008; Winsler et al. 2007).

In response to Lidstone et al.'s (2009) study, as well as the expanding amount of contradictory evidence in the area of inner speech use in ASD, Williams and Jarrold (2010) re-analyzed data from Williams et al.'s (2008) study to test the findings of Lidstone et al.'s (2009) study. Results from a short-term memory recall task (from Williams et al., 2008) revealed that only verbal ability, as opposed to the discrepancy between nonverbal and verbal abilities (from Lidstone et al., 2009), predicted inner speech use for children with ASD. This study provides further evidence for the idea that both low verbal abilities and a diagnosis of autism together predict inner speech use. Williams and Jarrold (2010) suggest it may be that some children with ASD use inner speech for some purposes but not others, or in certain contexts but not others.

The findings of private speech impairments in children with ADHD and possible inner speech impairments in children with ASD described above provide evidence for the notion of similar private speech impairments in children with ASD. The relatively negative parent-child interactions that are characteristic of children with ADHD (eg., Anderson et al., 1994; Winsler, 1998; Winsler et al., 1999) indicate that the inattentive and behavioral problems of children with ASD may result in similar interactions with

their parents, perhaps, further disrupting private speech use and self-regulation for these children. However, other evidence of positive parent-child interactions among children with ASD (eg., Guralnick et al., 2008) reveals that this may not be the case.

The Current Study

Using the same sample from the Winsler et al. (2007) study, children's executive functioning was examined using a physical task (Tower of Hanoi [TOH]) as opposed to computer-administered tasks. Similarly, private speech use and self-regulation of children with ASD was examined, but how parent-child interactions and parent scaffolding might relate to children's private speech and performance was additionally examined. Instead of using the articulatory suppression technique (like Holland & Low, 2009; Lidstone et al., 2009; Wallace et al., 2009; Whitehouse et al., 2006; Williams et al., 2008; Williams & Jarrod, 2010), overt private speech and partially internalized speech (e.g., whispers, muttering) were examined during the TOH first completed jointly, and then completed individually by the child. Participants included children with ASD, children with ADHD, and matched controls.

The following research questions were investigated: (1) Are there group differences in parent scaffolding during the dyad TOH?, (2) Does child executive performance (measured by child speech and performance in the individual TOH) differ by diagnosis group?, (3) Is parent scaffolding related to child use of private speech, and are relations the same across groups?, (4) Is parent scaffolding related to child executive performance and are relations the same across groups?, and (5) Is the relationship

between parent scaffolding and child executive performance mediated by child private speech?

METHOD

Participants

Data for this study were obtained from the same sample as Winsler et al. (2007). The participants included 82 children (females = 18) aged 7 to 18 years old ($M = 11.06$, $SD = 2.86$) diagnosed with high functioning ASD ($n = 33$, females = 1) or ADHD ($n = 21$, females = 8), and typically developing children ($n = 28$, females = 9) and their parents. Of the 33 children with ASD, 27% ($n = 9$) were diagnosed with high-functioning autism (HFA), 61% ($n = 20$) were diagnosed with Asperger syndrome, and 12% ($n = 4$) were diagnosed with pervasive developmental disorder not otherwise specified (PDD/NOS). Most of the children (95%) attended public schools (4% private and 1% home schooled), and 40% of the ADHD children and 75% of those with ASD received some form of special education services (either self-contained special education classrooms or pull out services) (see Table 1 for demographics by diagnosis group).

Table 1
Demographics by Diagnosis Group (Percentages are Within Group): Means and SDs

Demographic	ASD ($n=33$)	ADHD ($n=21$)	Control ($n=28$)	Total ($n=82$)
Gender (% males)	97%	62%	68%	78%
Parent's Ethnicity				
Caucasian	88%	95%	93%	91%
African American	6%	0	4%	4%

Hispanic	0	5%	0	1%
Other	6%	0	3%	4%
Parent's Education				
Completed high school	0	5%	0	1%
Some college	15%	24%	21%	20%
Completed college	36%	24%	32%	32%
Some graduate work	15%	14%	7%	12%
Master's degree	30%	29%	36%	32%
Doctoral degree	3%	5%	4%	4%
Marital Status				
Married	85%	95%	89%	89%
Single-divorced	12%	5%	11%	10%
Single-never married	3%	0	0	1%
Child age (in years)	11.64 (2.80)	11.00 (2.30)	10.43 (3.23)	11.06 (2.86)
Parent age (in years)	43.79 (6.65)	45.26 (5.97)	40.68 (4.47)	43.05 (6.02)
Total family income	6.70 (2.04)	8.06 (1.92)	6.68 (2.03)	7.04 (2.07)

Note. For parent age, there was missing data for two participants. For total family income, there was missing data for 12 participants. Total family income was measured on an ordinal scale with values ranging from 1 to 11 (1 = less than \$10,000; 11 = \$200,000 or more; overall mean of 7.04 = \$101,000 – \$125,000).

Children with ASD and ADHD were recruited from a variety of community agencies and clinics, as well as relevant online support groups and listservs. Control children were recruited using similar methods. Additionally, informal contacts were used, along with the university's established child development research lab database of families who expressed interest in participating in research studies.

Procedures

Two graduate research assistants collected data on campus in two laboratory rooms. Researchers greeted the participants upon arriving to campus, and engaged in a five-minute rapport-building session with the parent-child dyad, during which, the contents of the session were explained. Informed consent was obtained from the parent for both the child and parent to participate in the study and to allow the session to be videotaped. Parents were instructed to help as much as they liked in the Tower of Hanoi task, and after completing the task together, the child would be completing the task again alone. The dyad was told to take as much time as they wanted, but the goal was to solve the puzzle in the fewest number of moves possible (see below for more details on the rules of the task). When the child and adult were ready, the parent-child dyad first completed the Tower of Hanoi task together, and then the parent left the room and the child completed the task again individually. Videotaped sessions were transcribed and coded for private speech use. Additionally, a global scaffolding rating system was developed to code for parent scaffolding during the joint task.

Measures

Data on children's executive functioning were collected during completion of the Tower of Hanoi task. During this task, children's use of private speech (only in the individual session), child and parent performance, and quality of parent scaffolding were measured.

Executive functioning. Information on executive functioning (planning) was measured using the Tower of Hanoi – Revised (TOH-R; Welsh, Pennington, & Groisser,

1991). This problem-solving task measures executive functioning processes such as planning and cognitive inhibition. The puzzle consists of three pegs and four rings of different sizes that can slide onto any peg. The puzzle starts with the rings stacked on one peg in ascending order with the smallest ring on the top. The objective is to move the entire stack to another peg while obeying three rules: (1) only one ring can be moved at a time, (2) each move consists of taking only the top ring from one of the pegs and sliding it onto another peg, on top of the other rings that may already be present, and (3) a larger ring may not be placed on top of a smaller ring. The task can be completed in a minimum of 15 moves. The total number of moves the child (or dyad) made to complete this task was used as a means of measuring child executive performance, with larger numbers indicating poorer performance.

Child executive performance was assessed using three measures: total moves in the individual TOH, change in total moves from the dyad to the individual session (individual moves minus dyad moves), and overall private speech per minute during the individual TOH. The second measure of child executive performance was calculated by subtracting the total number of moves in the dyad TOH (parent + child) from the total number of moves in the individual TOH. This individual – dyad difference score was coded such that negative values mean total moves decreased from the dyad TOH to the individual TOH, representing an improvement in child executive performance.

Private speech. Child speech during the dyad session and child social and private speech during the individual session were carefully transcribed from the videotapes of the puzzle task. The unit of analysis for speech was an utterance, defined as a complete

sentence, a sentence fragment, or a string of speech that is temporally separated from another by at least three seconds (Winsler, 1998). First, child speech utterances during the individual sessions were classified as either social or private ($k = .75$, agreement = 91%). Indicators of social speech included any speech directed at or intended for another individual indicated by looking in the direction of another individual, a response to a statement/question of another individual, a question directed to another individual, or repetition to get the attention of an individual. Indicators of private speech included any verbalization made by the child that was not explicitly directed toward another person as indicated by the above signals of social intent (Winsler, 1998).

Private speech utterances were classified according to Berk's (1986) three-category coding system, which distinguishes child utterances based on level of overtness (volume) and task-relevance. Type 1 includes overt (regular volume), task-irrelevant private speech, such as word play, affect expressions, or comments to imaginary others (e.g., "I love chocolate ice cream!"). Type 2 includes overt, task-relevant private speech, such as statements about the task or the child's ongoing or future task-related activity (e.g., "That can't go there," "I can do it."). Type 3 includes task-relevant external manifestations of inner speech, such as whispering, inaudible muttering, and silent, verbal mouth movements. Two blind raters classified child speech utterances on a random 20% subsample of the transcripts to assess inter-rater reliability. Kappa was .86, and percentage agreement was .95.

The joint session was divided into thirds based on time in order to assess change throughout the session. The total number of child utterances was coded overall, per

minute, and per minute in each third. In the individual session, the total number of child social and private speech utterances were each coded, as well as the total number and percentage of each of the three levels of private speech. Overall private speech per minute and private speech per minute for each of the three categories of private speech were coded. All analyses including private speech were conducted using the 'per minute' variables in order to control for time. The length of sessions varied, so using the 'per minute' variables assessed the rate of private speech use as opposed to the quantity of private speech utterances. Finally, I also made a dichotomous variable indicating whether or not the child engaged in any private speech (1 = Yes, 0 = No) during the individual session.

Parent scaffolding. A global parent scaffolding rating system was developed for the current study (based on Baker, Fenning, Crnic, Baker, & Blacher, 2007; Berk & Spuhl, 1995; Hoffman, Crnic, & Baker, 2006; Winsler, 1998), which was used, as opposed to a microanalytic coding system, because previous evidence has shown that the overall quality of parent scaffolding was more associated with child private speech use and task performance than moment-by-moment coding (Berk & Spuhl, 1995). The global scaffolding measure consisted of five dimensions of scaffolding that each received a rating on a 5-point scale ranging from 1 (poor scaffolding) to 5 (excellent scaffolding). The five ratings were averaged to produce a global parent scaffolding rating. The five dimensions were: (1) parent's regulation of task demands/modifying or manipulating task materials (inter-rater reliability $r_S = .70$), (2) parent's encouragement of verbal problem solving and asking leading conceptual questions ($r_S = .78$), (3) appropriate use of praise

and other motivational enhancers and competence attributions ($r_S = .52$), (4) mutual collaboration and intersubjectivity (pursuit of shared goals; $r_S = .64$), and (5) parent's dynamic and appropriate modulation of assistance over the course of the session, withdrawal of regulatory control, and support of child's autonomy ($r_S = .46$). Parents were rated as using excellent scaffolding if, for example, they appropriately used positive statements about the child's performance (e.g., "good job," "great work"), asked helpful leading questions, and clearly decreased the amount of assistance they provided from the beginning to the end of the task as the child was able to do more of the task by themselves. In contrast, parents were rated as using poor scaffolding if they only made negative statements about the child's performance, took over control of the task and did it for the child, and/or was very directive. For a full description of the rules and guidelines, see Appendix. The author and a naïve undergraduate research assistant coded all of the videos. Inter-rater reliability was established for overall global scaffolding quality using about 10% of the videos ($r_S = .90$), but as seen above, inter-rater reliability for the individual subscale dimensions was not as strong.

In addition to the global scaffolding rating, four other measures were used to assess parent scaffolding: the proportion of dyad TOH moves made by the parent, the number of parent utterances per minute, the number of child utterances per minute in the dyad TOH, and the proportion of all dyad TOH utterances made by the child.

RESULTS

Preliminary analyses were conducted to determine if there were group differences (ASD, ADHD, control) on child demographic variables (see Table 1) or significant relations between child demographic variables and major dependent variables. There were no significant group differences in child age, but child age was negatively correlated with parent speech in the dyad TOH ($r = -.32, p < .05$), negatively correlated with child speech in the individual TOH ($r = -.22, p < .10$), and positively correlated with the proportion of child utterances in the dyad TOH ($r = .20, p < .10$). As a result, all analyses were conducted with and without controlling for child age, and all analyses are reported controlling for child age. Full-scale IQ scores (collected only for children diagnosed with ADHD or ASD) were negatively correlated with parent speech in the dyad TOH ($r = -.55, p < .05$). There were significant group differences in parent's age, such that the parents of children with ADHD ($M = 45.26, SD = 5.97$) or ASD ($M = 43.79, SD = 6.65$) were slightly older than those of typically developing children ($M = 40.68, SD = 4.47$), $F(2, 77) = 3.98, p < .05$.

Research Question 1

The first research question examined group differences in parent scaffolding (all five measures described above) during the dyad TOH. Parent scaffolding was assessed using five measures: the global scaffolding rating, the proportion of dyad TOH moves

made by the parent, the number of parent utterances per minute, the number of child utterances per minute in the dyad TOH, and the proportion of all dyad TOH utterances made by the child. Overall group differences in these five measures were examined using five one-way ANCOVAs with diagnosis group as the independent variable, child age as the covariate, and each of the parent scaffolding measures included in turn as the dependent variable. Group differences in the speech scaffolding measures (number of parent utterances per minute and number of child utterances per minute in the dyad TOH) for each third of the dyad TOH were also assessed using repeated-measures ANCOVAs. Table 2 includes means and *SDs* overall and by diagnosis group for all parent scaffolding measures.

Table 2
Parent Scaffolding, Speech, and Performance Measures in Dyad TOH by Diagnosis Group (Controlling for Child Age): Means and SDs

Measure	ASD (<i>n</i> =33)	ADHD (<i>n</i> =21)	Control (<i>n</i> =28)	Total (<i>n</i> =82)
Global Scaffolding Rating ⁺	2.78 (.82)	2.85 (.84)	3.21 (.57)	2.94 (.76)
Total utterances (parent + child)	76.52 (60.60)	65.29 (32.24)	97.04 (75.19)	80.65 (61.26)
Total child utterances*	16.58 (17.28) _a	19.57 (12.10) _a	41.43 (41.76) _b	25.83 (29.40)
1 st Third*	5.70 (5.96) _a	6.67 (5.20) _a	14.04 (14.15) _b	8.79 (10.10)
2 nd Third*	5.52 (6.22) _a	6.10 (4.27) _a	14.14 (13.22) _b	8.61 (9.70)
3 rd Third*	5.37 (7.01) _a	6.81 (5.64) _{ab}	13.25 (15.40) _b	8.43 (10.90)
Total child utterances per minute*	5.55 (4.82) _a	7.44 (5.02) _a	11.83 (6.85) _b	8.18 (6.21)
1 st Third*	5.64 (4.58) _a	8.14 (7.31) _a	12.51 (7.69) _b	8.63 (7.08)
2 nd Third*	5.81 (7.03) _a	6.63 (4.15) _a	12.41 (6.77) _b	8.27 (6.94)

3 rd Third*	5.20 (5.97) _a	7.55 (6.12) _{ab}	10.57 (8.28) _b	7.63 (7.18)
Proportion of total utterances made by child*	.24 (.15) _a	.32 (.17) _a	.42 (.16) _b	.32 (.17)
Total parent utterances	59.94 (49.26)	45.71 (26.46)	55.61 (41.91)	54.82 (41.83)
1 st Third	19.94 (16.91)	14.10 (10.74)	18.14 (14.79)	17.83 (14.83)
2 nd Third ⁺	20.36 (17.18)	13.33 (9.00)	17.07 (14.23)	17.44 (14.56)
3 rd Third	19.64 (17.53)	18.29 (9.62)	20.39 (15.89)	19.55 (15.14)
Total parent utterances per minute	17.51 (9.20)	17.04 (10.02)	16.42 (7.62)	17.02 (8.82)
1 st Third	17.68 (10.49)	15.28 (9.23)	15.73 (8.07)	16.40 (9.35)
2 nd Third	18.01 (10.78)	14.87 (10.50)	15.42 (8.16)	16.32 (9.86)
3 rd Third	16.85 (10.78)	20.97 (13.45)	18.12 (10.84)	18.34 (11.51)
Total moves (parent + child)	33.36 (24.19)	35.43 (13.50)	30.54 (14.10)	32.93 (18.61)
Proportion of moves made by parent	.17 (.26)	.08 (.14)	.19 (.23)	.16 (.23)
Proportion of moves made by child	.82 (.26)	.92 (.14)	.81 (.23)	.84 (.23)

Note. Means in the same row that do not share subscripts differ at $p < .05$ by Bonferroni adjusted post-hoc comparisons.

*ANCOVA $p < .05$

⁺ $p < .10$.

Global scaffolding rating. Results suggested marginally significant group differences in the overall global scaffolding rating controlling for child age, $F(2, 79) = 2.97, p = .06, \eta_p^2 = .04$. Post-hoc analyses indicated that parents of children with ASD ($M = 2.78, SD = .82$) were rated as engaging in lower quality scaffolding than typically developing children ($M = 3.21, SD = .57$). There were no significant differences between

parents of children with ADHD ($M = 2.85$, $SD = .84$) and parents of children with ASD, or parents of typically developing children (see Table 2).

To try to get a better feel for how the groups are differing in terms of scaffolding, I also examined group differences in the five subscale scaffolding scores: (a) task regulation/manipulation, b) appropriate use of praise and motivational tone, c) collaboration/intersubjectivity, d) verbal problem solving/leading questions, and e) appropriate withdrawal of control. Because the inter-rater reliability of the subscale scores was weak, these analyses should be considered preliminary and exploratory. There were marginal group differences in the appropriate use of praise and motivational statements, such that scaffolding quality was marginally lower for ASD children compared to controls. There were no group differences in the other four dimensions, but parent scaffolding quality was rated as either lower for ASD children, or roughly the same as ADHD children in every dimension compared to controls (with both groups lower than controls and ASD children the lowest).

Proportion of dyad TOH moves made by the parent. Results suggested no significant group differences in the proportion of the dyad TOH moves made by the parent controlling for child age, $F(2, 78) = 1.73$, $p = .18$. Although there were no significant group differences, parents of children with ASD ($M = .17$, $SD = .26$) and parents of typically developing children ($M = .19$, $SD = .23$) made slightly more moves during the dyad TOH than parents of children with ADHD ($M = .08$, $SD = .14$) (see Table 2 for means and SD s and Figure 1 for total number of child moves and total number of parent moves in the dyad TOH). It's important to note that the mean number of total

moves for all three groups was about 30 and a perfect score on the task would be 15 total moves, so the task was relatively difficult for all groups.

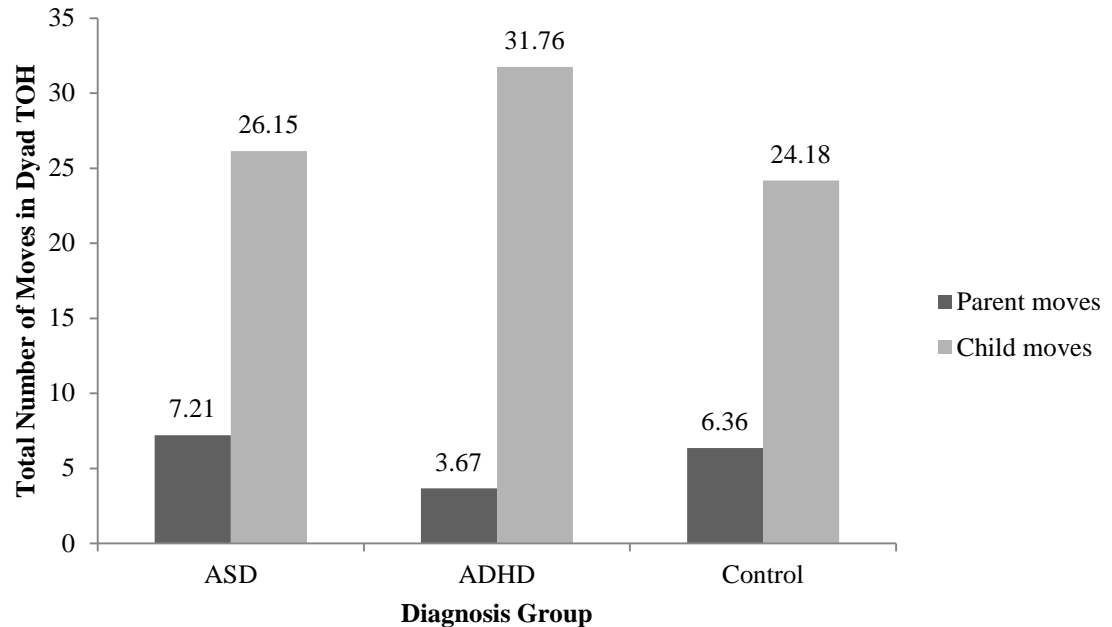


Figure 1
Group mean differences in total number of parent moves and child moves in the dyad TOH, controlling for child age. All group differences were non-significant.

Number of parent utterances per minute. Group differences in the number of parent utterances per minute were assessed overall and in each third in the dyad TOH, controlling for age. Overall, results suggested no significant group differences in the number of parent utterances per minute, $F(2, 78) = .49, p = .61$ (see Table 2).

Results of the repeated-measures ANCOVA suggested a marginally significant main effect of time on the number of parent utterances per minute, $F(2, 156) = 2.45, p = .09$. Additionally, there was no significant effect of child's diagnosis, $F(2, 78) = .49, p = .61$. There was, however, a significant interaction effect between time and child's diagnosis, $F(4, 156) = 2.60, p = .04$. Parents of typically developing children and children with ADHD tended to increase their speech over time, whereas parents of children with ASD decreased their speech (see Figure 2). Often there was an 'aha!' moment when the dyad figured out how to solve the task which generated a burst in utterances toward the end of the session, but this effect was not observed for parents of children with ASD.

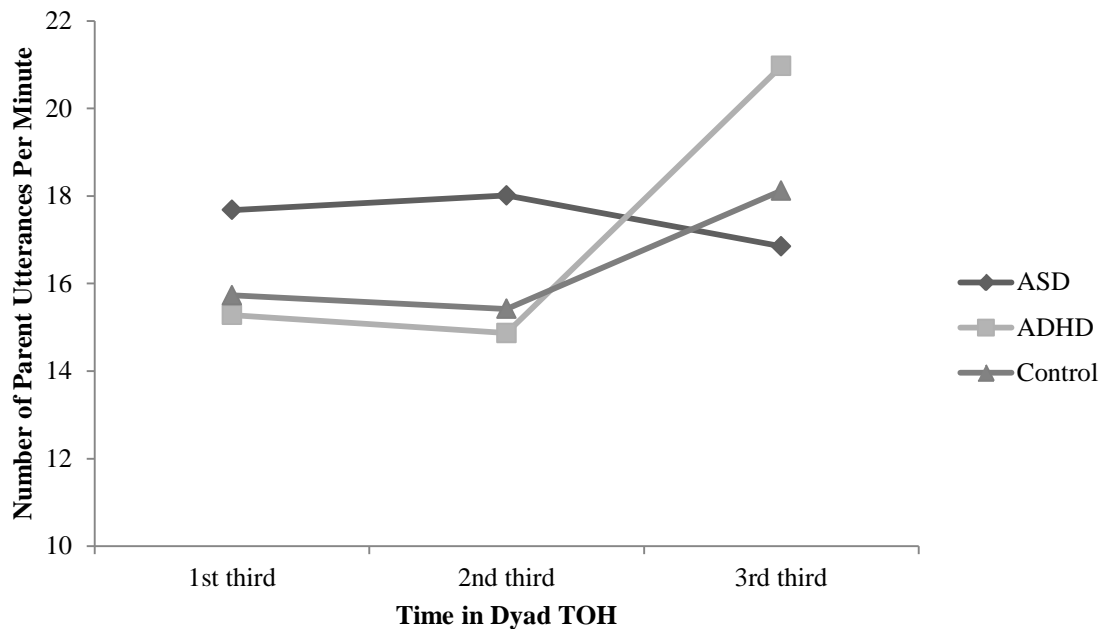


Figure 2
Group mean differences in number of parent utterances per minute over time, controlling for child age.

Diagnosis: $F(2, 156) = 2.45, p = .09$
Time: $F(2, 78) = .49, p = .61$
Diagnosis \times Time: $F(4, 156) = 2.60, p < .05$.

Number of child utterances per minute in dyad TOH. Group differences in the number of child utterances per minute were assessed overall and in each third in the dyad TOH, controlling for age. Overall, results suggested significant group differences in the number of child utterances per minute, $F(2, 78) = 10.83, p < .05, \eta_p^2 = .22$. Post-hoc analyses indicated that typically developing children ($M = 11.83, SD = 6.85$) talked the most, and this was significantly different from both children with ADHD ($M = 7.44, SD = 5.02$) and ASD ($M = 5.55, SD = 4.82$). Children with ASD tended to talk the least, but this was not significantly different from children with ADHD (see Table 2).

Results of the repeated-measures ANCOVA suggested no significant main effect of time on the number of child utterances per minute, $F(2, 156) = .29, p = .75$. Although there was a significant effect of child's diagnosis on the number of child utterances per minute (see above), there was no significant interaction effect between time and child's diagnosis, $F(4, 156) = .90, p = .46$ (see Figure 3).

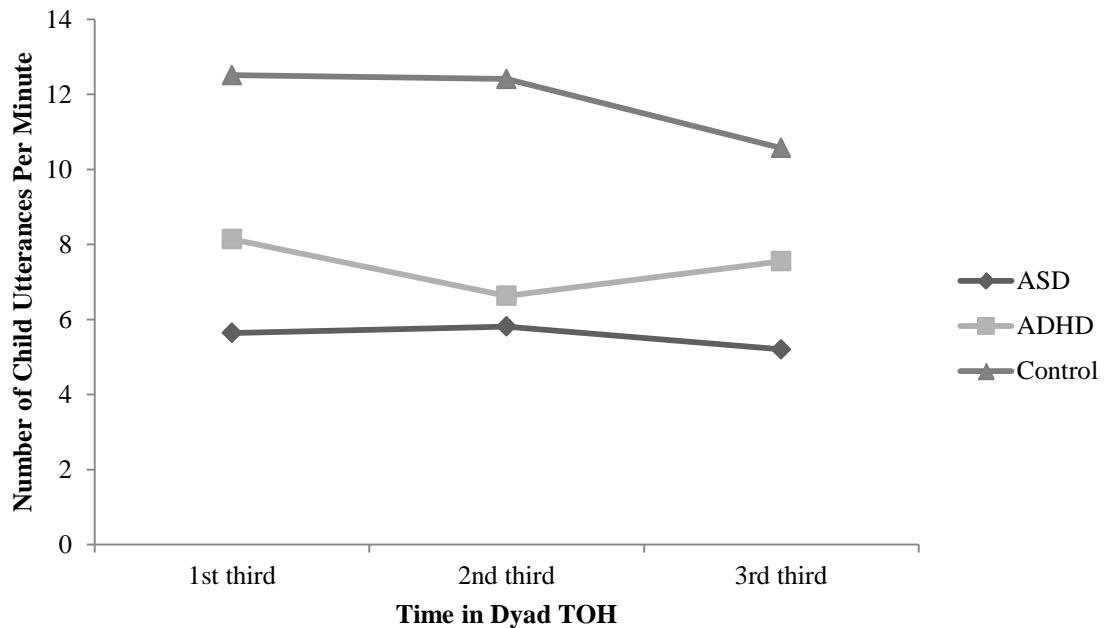


Figure 3
 Group mean differences in number of child utterances per minute over time, controlling for child age.
 Diagnosis: $F(2, 78) = 10.83, p < .05, \eta_p^2 = .22$
 Time: $F(2, 156) = .29, p = .75$
 Diagnosis \times Time: $F(4, 156) = .90, p = .46$.

Proportion of dyad TOH utterances made by the child. Results suggested significant group differences in the proportion of dyad TOH utterances made by the child controlling for age, $F(2, 78) = 13.12, p < .05, \eta_p^2 = .25$. Post-hoc analyses indicated that typically developing children ($M = .42, SD = .16$) talked significantly and proportionately more than both children with ADHD ($M = .32, SD = .17$) and ASD ($M = .24, SD = .15$). Also, children with ADHD talked marginally more than children with ASD (see Table 2).

Research Question 2

The second research question investigated whether child task and speech performance differed in the individual TOH by diagnosis group. Child executive performance was assessed using total moves in the individual TOH, total change in moves from the dyad to the individual session (individual moves minus dyad moves), and overall private speech per minute during the individual TOH (see Method section for explanation of measures). Group differences in these measures were analyzed using three one-way ANCOVAs with diagnosis group as the independent variable, child age as the covariate, and each of the executive performance measures in turn as the dependent variable. Table 3 includes means and *SDs* overall and by diagnosis group for all child performance measures.

Table 3
Child Speech and Performance in Individual TOH by Diagnosis Group (Controlling for Child Age): Means and SDs

Measure	ASD (<i>n</i> =33)	ADHD (<i>n</i> =21)	Control (<i>n</i> =29)
Overall private speech (PS)			
Total utterances	6.39 (13.86)	6.62 (15.54)	5.38 (9.02)
Total utterances per minute	1.94 (4.47)	2.67 (3.75)	2.99 (4.15)
Used PS overall? (yes/no)*	51.60%	85.70%	73.10%
Overt, task-irrelevant (Type 1) PS			
Total utterances	.16 (.90)	.05 (.22)	0
Total utterances per minute	.03 (.18)	.03 (.16)	0
Used Type 1 PS? (yes/no)	3.20%	4.80%	0%
Overt, task-relevant (Type 2) PS			
Total utterances	5.68 (13.67)	6 (14.81)	3 (4.52)
Total utterances per minute	1.51 (4.21)	2.41 (3.75)	2.29 (3.84)
Used Type 2 PS? (yes/no)*	41.90%	76.20%	53.80%

Covert, task-relevant (Type 3) PS

Total utterances	.55 (1.23)	.57 (1.03)	2.38 (7.96)
Total utterances per minute	.39 (1.23)	.22 (.53)	.70 (1.23)
Used Type 3 PS? (yes/no)	29.00%	33.30%	50.00%
Total child moves	39.30 (30.36)	38.71 (24.81)	28.64 (11.81)
Total moves (individual minus dyad)	7.00 (34.86)	3.29 (25.35)	-1.89 (17.57)

Note. Total moves (individual minus dyad): change in total moves from the dyad TOH to the individual TOH; positive numbers mean total moves increased from the dyad TOH to the individual TOH, representing a decrease in child performance

*Chi-square $p < .05$.

Results indicated that none of the child performance measures significantly differed by diagnosis group. Although not significant, it is notable that the performance of the ASD and ADHD groups did not improve from the dyad TOH to the individual TOH (as indicated by positive values meaning an increase in total moves), whereas the typically developing children slightly improved their performance (as indicated by a negative value meaning a decrease in total moves; see Table 3 and Figure 4).

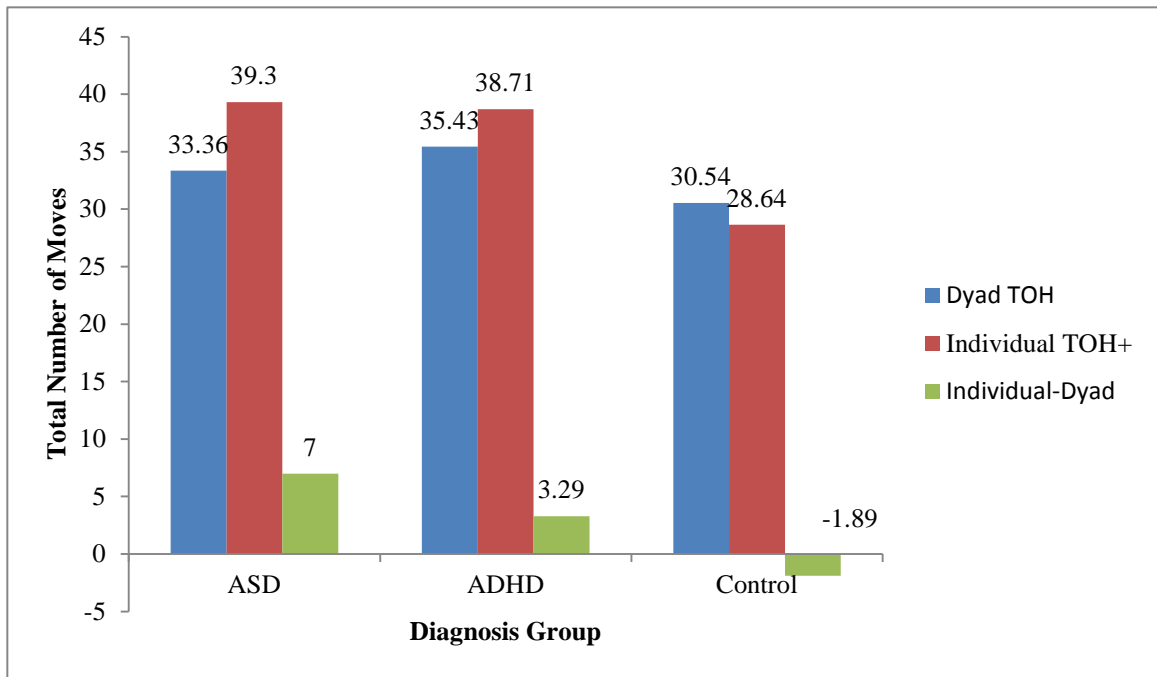


Figure 4

Group mean differences in child task performance measures, controlling for child age (dyad TOH total moves, individual TOH total moves, change in total moves from the dyad TOH to the individual TOH). Change in total moves from the dyad TOH to the individual TOH: negative values mean total moves decreased from the dyad TOH to the individual TOH, representing improvement in child performance.

+ $p < .10$.

In addition, chi-square analyses were conducted to assess group differences in whether or not children used private speech, with diagnosis group as the independent variable and whether or not children used private speech (yes or no) as the dependent variable. Results indicated significant group differences in whether or not children used private speech overall (ASD: 51.60%, ADHD: 85.70%, control: 73.10%) ($\chi^2(2) = 7.16, p < .05$), and whether or not they used Type 2 (relevant) private speech (ASD: 41.90%, ADHD: 76.20%, control: 53.80%) ($\chi^2(2) = 5.96, p < .05$). This suggests that the majority

of children with ADHD and typically developing children talked to themselves, as compared to only half of children with ASD. There were no significant group differences in whether or not Type 1 (irrelevant) private speech or Type 3 (partially internalized) private speech was used, which could be due to the fact that most children, overall, did not use irrelevant private speech and only a quarter to half of children used partially internalized private speech (see Table 3 and Figure 5).

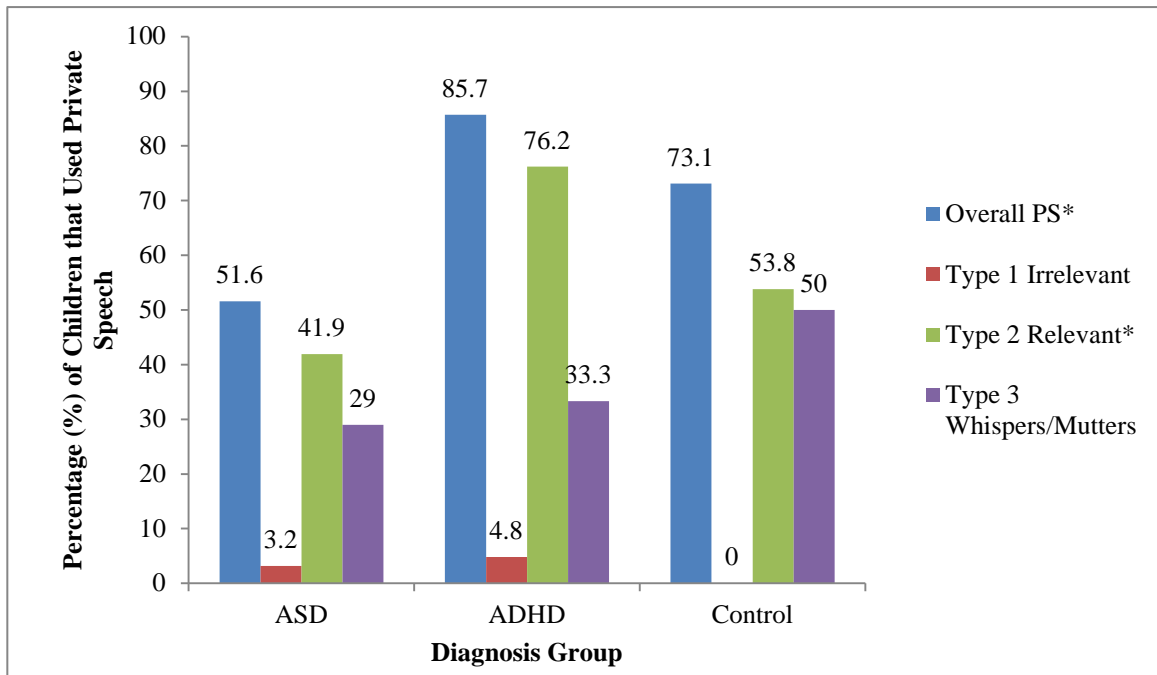


Figure 5
Group differences in percentage of children that used private speech, overall and by private speech type, in the individual TOH.

* Chi-Square $p < .05$.

Research Question 3

The third research question investigated whether parent scaffolding was related to child use of private speech (controlling for age), and if this relationship differed across groups. The relationship between parent scaffolding and child private speech was assessed using partial correlations between the five parent scaffolding measures in the dyad TOH and child private speech (measured by overall private speech per minute and Type 2 private speech per minute) in the individual TOH, overall and by diagnosis group, controlling for age (see Table 4). As mentioned above, most children did not use Type 1 (irrelevant) private speech and less than half of children used Type 3 (partially internalized) private speech. There were no significant relations between the five parent scaffolding measures and Type 1 or Type 3 child private speech per minute overall or by group, thus these two measures were not included in Table 4.

Table 4

Partial Correlations between Parent Scaffolding in the Dyad TOH and Performance and Speech (Type 2 Private Speech Per Minute and Total Private Speech Per Minute) in the Individual TOH Overall and by Group (Controlling for Child Age)

Parent Scaffolding Measures	Overall			ASD			ADHD			Control		
	Perf. (<i>n</i> =79)	PS ₂ (<i>n</i> =78)	PS _T (<i>n</i> =78)	Perf. (<i>n</i> =30)	PS ₂ (<i>n</i> =31)	PS _T (<i>n</i> =31)	Perf. (<i>n</i> =21)	PS ₂ (<i>n</i> =21)	PS _T (<i>n</i> =21)	Perf. (<i>n</i> =28)	PS ₂ (<i>n</i> =26)	PS _T (<i>n</i> =26)
Global scaffolding rating	-.08	.02	.04	.04	.01	.03	-.12	.04	.03	-.30	.08	.06
Proportion of parent moves in dyad	-.09	-.06	-.11	-.05	-.08	-.13	-.31	-.11	-.15	-.01	.06	-.01
Total parent utterances per minute in dyad	.21 ⁺	.02	.03	.34 ⁺	.05	.05	.06	-.10	-.10	.29	.05	.10
Total child utterances per minute in dyad	-.23*	.32*	.34*	-.07	.55*	.64*	-.23	.38 ⁺	.43 ⁺	-.22	.11	.01
Proportion of child utterances in dyad	-.35*	.25*	.25*	-.26	.36*	.45*	-.37	.36	.36	-.34 ⁺	.01	-.14

Note. Perf. = child task performance; PS₂ = Type 2 private speech per minute; PS_T = total private speech per minute

* Pearson correlation $p < .05$

⁺ $p < .10$.

Total and relevant (Type 2) private speech per minute. The global scaffolding rating, the proportion of parent moves in the dyad, and the total parent utterances per minute in the dyad were not significantly related to children's private speech use overall or across groups, or to children's use of relevant private speech overall or across groups. The number of child utterances per minute in the dyad was significantly related to children's private speech use overall ($r_p = .34, p < .05$), and for children with ASD ($r_p = .64, p < .05$), and was marginally related for children with ADHD ($r_p = .43, p < .10$). Following a similar pattern, the number of child utterances per minute in the dyad was significantly related to children's relevant private speech use overall ($r_p = .32, p < .05$), and for children with ASD ($r_p = .55, p < .05$), and was marginally related for children with ADHD ($r_p = .38, p < .10$). This suggests that more child speech in the dyad session is associated with more private speech use overall, and private speech that is relevant, in the individual session for those with ASD or ADHD, but interestingly not for typical children. The proportion of child utterances in the dyad was significantly related to child private speech use overall ($r_p = .25, p < .05$), and for children with ASD ($r_p = .45, p < .05$), with the same but non-significant trend for those with ADHD. Similarly, the proportion of child utterances in the dyad was significantly related to children's use of relevant private speech overall ($r_p = .25, p < .05$), and for children with ASD ($r_p = .36, p < .05$), with the same but non-significant trend for those with ADHD. These findings suggest that, proportionately, the more children with ASD (and ADHD) talked in the dyad, the more they used private speech that is relevant, and in general, in the individual TOH, but this was not observed for the typically developing children.

Research Question 4

The fourth research question investigated whether parent scaffolding was related to child executive performance (controlling for age), and if this relationship differed across groups. Table 4 also includes partial correlations between the five parent scaffolding measures in the dyad TOH and child performance in the individual TOH (total number of moves in the individual TOH) overall and by diagnosis group after controlling for age.

Both global scaffolding rating and the proportion of parent moves in the dyad were not significantly related to child performance overall or across groups. The number of parent utterances per minute was marginally related to child performance for children with ASD ($r_P = .34, p < .10$), suggesting that the more parents talked during the dyad TOH, the worse ASD children tended to perform in the individual TOH. The number of child utterances per minute in the dyad was significantly related to overall child performance in the individual TOH ($r_P = -.23, p < .05$), suggesting that the more children talked during the joint task, the better they performed in the individual session. In addition, the proportion of child utterances in the dyad was significantly related to child performance in the individual TOH overall ($r_P = -.35, p < .05$), and marginally related for typically developing children ($r_P = -.34, p < .10$), with the same pattern for the other groups as well but non-significant due to the smaller cell sizes within group. This finding suggests the more the parent gets the child talking in the dyad, the better the child performs in the individual session.

Research Question 5

The fifth research question investigated whether relations between parent scaffolding and child executive performance was mediated by child private speech. As mentioned above in Research Question 4, overall child performance in the individual TOH was significantly related to two of the five parent scaffolding measures: the number of child utterances per minute in the dyad, and the proportion of child utterances in the dyad. Additionally, child performance in the individual TOH was marginally related to a third parent scaffolding measure: the number of parent utterances per minute in the dyad TOH (see Table 4). Overall and across diagnosis groups, the global scaffolding rating and the proportion of parent moves in the dyad TOH were not significantly related to child performance in the individual TOH. The first step in mediation analyses is to test whether the independent variable is related to the dependent variable. Since two of the five parent scaffolding measures/independent variables (the global scaffolding rating and the proportion of parent moves in the dyad TOH) were not related to child performance/the dependent variable, mediation was not investigated for those variables.

Mediation was investigated using multiple regression in a three-step analysis for each of the three parent scaffolding measures (number of parent utterances per minute in the dyad, number of child utterances per minute in the dyad, and proportion of child utterances in the dyad) that were significantly related to child performance in the individual session. As mentioned above, the first step in mediation analysis is to investigate whether the independent variable is related to the dependent variable. Child performance was regressed on to each of the three parent scaffolding measures in three separate multiple regressions with child performance as the dependent variable, child age

entered in Step 1, and each of the three parent scaffolding measures, in turn, entered in Step 2. The second step in mediation analysis is to test whether the mediator is related to the dependent variable. Child performance was regressed on to child private speech (private speech per minute in the individual TOH) in a multiple regression with child performance as the dependent variable, child age entered in Step 1, and private speech per minute entered in Step 2. The third step in mediation analysis is to test whether the independent variable and the mediator, together, are related to the dependent variable. However, none of the three mediation analyses were investigated beyond the second step because the mediator (child private speech per minute) was not related to the dependent variable (child performance in the individual TOH). Note that only the independent variable changed between the analyses (the mediator and dependent variable remained the same). Table 5 shows the regression statistics for the first step of each of the three parent scaffolding measures and the second step, which was the same for all three mediation analyses.

The first step in the mediation analyses was to test whether each of the three parent scaffolding measures, in turn, were related to child performance in the individual session after controlling for child age. Results indicated that the number of parent utterances per minute in the dyad session was marginally related to child performance in the individual session, $\Delta F(1, 76) = 3.34, p < .10$, the number of child utterances per minute in the dyad was significantly related to child performance in the individual session, $\Delta F(1, 76) = 4.11, p < .05$, and the proportion of child utterances per minute in the dyad was significantly related to child performance in the individual session, $\Delta F(1, 76) =$

10.47, $p < .05$ (see Table 5). The second step in the mediation analysis (testing whether child private speech in the individual session was related to child performance in the individual TOH) indicated that after controlling for age, child private speech per minute was not significantly related to child performance in the individual session, $\Delta F(1, 74) = .71, p > .05$, so mediation was not investigated further.

DISCUSSION

The goal of this study was to examine the role of parent-child interactions and parent scaffolding in the private speech use and executive functioning of children with high-functioning ASD during a joint activity. Only one other study (Winsler et al., 2007) has examined private speech use among children with ASD, which used two computer-administered executive functioning tasks that were completed individually, whereas this study used a physical puzzle task that was completed both jointly with the parent and individually. Winsler et al. (2007) found that children with ASD were just as likely as controls to use task-relevant private speech, whereas this study found that children with ASD were less likely than controls to use private speech after having worked with their parents, in general, but when they did, their speech use was similar to the other groups. Although the findings from Winsler et al. (2007) were not completely replicated, the main goal of this study was to examine the quality of parent scaffolding of children with ASD, which has not been previously investigated, and whether it was related to child private speech and performance when the child completed the puzzle task alone. Given that ASD is similar to ADHD, in that, both are primarily characterized as self-regulatory disorders in which children have difficulty planning and controlling/inhibiting disruptive behaviors (Schroeder & Kelley, 2009; Stevens, Quittner, Zuckerman, & Moore, 2002), it is possible that parent-child interactions would also be similar. There is evidence of

relatively negative parent-child interactions among children with ADHD (Anderson et al., 1994; Winsler, 1998; Winsler et al., 1999), suggesting that the behavioral problems of children with ASD may contribute to similar parent-child interactions. In contrast, there is also evidence of positive parent-child interactions among children with ASD (Guralnick et al., 2008).

A global scaffolding rating system was developed to assess the overall scaffolding quality of parent-child interactions. Marginal group differences in overall parent scaffolding were found, such that parents of children with ASD were rated as engaging in lower quality scaffolding than parents of typically developing children, and there were no differences between the parents of children with ADHD and the other two groups. Exploration of the global scaffolding subscales revealed that it was the dimension having to do with motivational tone and appropriate use of praise that was most different for dyads involving children with ASD.

Four additional measures were examined in the dyad session to investigate, in more depth, the nature of the verbal and nonverbal parent-child scaffolding interaction patterns, including the proportion of parent moves in the dyad session, the total number of parent utterances per minute in the dyad, the total number of child utterances per minute in the dyad, and the proportion of child utterances in the dyad (with 'per minute' speech variables used in order to control for time). Interestingly, parent speech of children with ASD tended to decrease over time (from the beginning to the end of the dyad session), whereas parent speech tended to increase for children with ADHD and controls. During the joint session, there was often a moment when the dyad figured out

how to solve the puzzle, which generated a burst in parent speech for typically developing and ADHD children, but not for ASD children. In addition, typically developing children talked more than both children with ADHD and ASD in the joint session, and ASD children talked the least. Together, the five measures of parent scaffolding suggest that parents of ASD children engage in slightly lower quality scaffolding than both ADHD and typically developing children.

There were no group differences in child task performance and speech in the individual session; however, analyses between children who used private speech and those who did not revealed that the majority of children with ADHD and typically developing children talked to themselves (and their speech was relevant), as compared to only about half of children with ASD. Previous research with the same sample, but using individual electronic executive functioning tasks, found that ASD children were just as likely to use private speech as control children, and when they did, it helped them to regulate their performance (Winsler et al., 2007). It is difficult to speculate why after a parent-child scaffolding session, the ASD children used less private speech. Perhaps, ASD children's private speech is elicited and used more during individual child activities and the introduction of a collaborative problem-solving partner, such as their parent, inhibits their use of private speech for self-regulation. Another possibility is that the task was "easier" when the child completed it alone because s/he had already completed it once with their parent, so the use of private speech on this was less necessary than in the computerized task employed in Winsler et al. (2007), which was completed once, individually. Finally, given previous research showing the social origins of private speech

use and internalization (e.g., Berk & Spuhl, 1995; Vygotsky, 1987; Winsler, 2009), and the fact that children with ASD are known to have significant difficulties with social interaction with others (e.g., Hill, 2004; Russell, 1997), perhaps children with ASD have greater problems using self-regulatory private speech, specifically when in social contexts.

It is interesting that none of the five parent scaffolding measures were related to child performance in the individual session, or to both overall or relevant private speech use in the individual session for controls (with one exception: the proportion of child utterances in the dyad was marginally related to individual performance). This is inconsistent with previous research indicating that high-quality parent scaffolding is positively related to both children's executive functioning performance (Landry et al., 2002) and private speech use for typically developing children (Berk & Spuhl, 1995). Although not statistically significant, the correlations between the parent scaffolding measures and child performance and child private speech use in the individual session did follow the same trends that were found in the literature. For ASD children, the amount of parent speech in the dyad was marginally related to child performance in the individual session, such that more parent speech was associated with poorer child performance. Perhaps, the parents of the low-functioning children (who did worse on the task) needed more, and elicited more, parent speech during the dyad, suggesting that it could be the child's level of functioning driving the parental effect. The direction of the effect is not clear with these correlational data. Additionally, child speech in the dyad was strongly related to child private speech use in the individual, such that the more ASD children

spoke in the dyad, the more they used private speech in the individual session, and it was relevant to the task.

Limitations

It is important to note the limitations of this study. First, the current study only included high-functioning children with ASD with intact language skills, and was unable to control for heterogeneity of functioning of the clinical groups, thus, future research should include assessments that would account for the high variability in functioning for these children with larger samples. Also, the unreliability of the subscales of the global scaffolding measure makes it difficult to explain why this study found that parents of children with ASD were rated as engaging in marginally lower quality scaffolding than typically developing children. Finally, the wide age range makes it difficult to understand what is going on with parent scaffolding, executive functioning, and private speech use because all measures differed with age. Future research should focus on a more narrow age range to examine scaffolding processes in more detail.

Conclusion

This study's findings indicate that, like parents of ADHD children, parents of children with ASD engage in lower quality scaffolding than typically developing children (Anderson et al., 1994; Winsler, 1998; Winsler et al., 1999). This is the first study to investigate directly the quality of parent-child interactions of ASD children, and it would appear that there might be interesting differences in need of further study. The Guralnick et al. (2008) paper examining parent-child interactions with a sample of children with mild developmental delays found that parent-child interactions were characterized as both

positive and sensitive, which was not replicated in this study. One clear implication of the present study is that child executive performance for all groups improved when parents talked less in the dyad and when children talked more in the dyad. The strong associations between child speech in the dyad and child performance in the individual session indicate that we should encourage children to talk during joint activities because it likely improves their performance later on when completing the same task alone. This is consistent with conceptions of scaffolding that emphasize the need to get involved as much as possible during joint problem solving and to withdraw adult control (Berk & Winsler, 1995). Another reason to encourage children to talk during joint activities is because of the strong positive associations with child private speech use, particularly for children with ASD. Children with ASD were less likely than controls to use private speech (or any speech during the dyad session) after their collaborative session with their parent, but when they did, their speech use was similar to the other groups, indicating that they are attempting to regulate their behavior by talking out loud to themselves. Interventions could focus on using private speech as a tool with other techniques to improve executive functioning skills and behavior of children with high-functioning autism (e.g., Dawson & Guare, 2010).

APPENDIX

Global Scaffolding Rating System

There are 5 dimensions of scaffolding that each receives a rating on a 5-point scale ranging from 1 (poor scaffolding) to 5 (excellent scaffolding). The 5 ratings are averaged to produce a global parent scaffolding rating.

Dimensions:

a. Parent's regulation of task demands/modifying or manipulating task materials

5 = no touching child or rings; occasional pointing or touching of the sheet/model, board, or peg is okay as long as the child is completing the task on their own (e.g., moving the board closer or further away from the child to make it easier)

4 = no blocking child (i.e., physically stopping the child from making a move by stopping their hand); occasional arm graze is okay as long as it's not blocking the child; occasional peg touching is okay

3 or below if the parent touches a ring or blocks the child at all

2 = if the parent touches a ring or blocks the child up to 3 or 4 times

1 = parent physically completes the majority of the task, or the parent does not provide any physical assistance with the task (e.g., pointing to or touching the sheet/model, board, or peg when child is stuck)

b. Parent's encouragement of verbal problem-solving and asking leading conceptual questions

5 = reminding the child of the task rules every time they're stuck or making mistakes and/or asking leading questions (e.g., "can you put that one there?", "what ring can go on this peg?", "is this one bigger than that one/is orange bigger than blue?", "what was the rule about...?", "how do we get this one over here?", "what if we...?") and/or asking broader questions (e.g., "what should we do next?", "where can we put this one?", "what are you thinking?")

3 = parent asks some questions when the child is stuck or making mistakes, but is sometimes silent; or, asking questions when it is not needed (when the child is not stuck)

1 = parent is completely silent when the child is stuck or making mistakes; or, the parent is verbally directing most of or the entire task

c. Appropriate use of praise and other motivational enhancers and competence attributions

5 = parent appropriately uses positive statements about the child's performance (e.g., "good job", "great work", "good idea"), competence attributions (e.g., "you're so smart", "you're quick", "you're good at this"), smiling, laughing, positive facial/body language (e.g., no frowning, crossing arms, or looking bored, indifferent, or angry; using head nods, thumbs up, pats on the back, high fives, clapping, hand shakes), other motivational enhancers (e.g., "take a few more steps", "that's the idea") and positive affect when the child is making correct moves

3 or below if the parent does any of the above when the child is making mistakes

3 = moderate use of the components for 5; or, the parent does any of the above when the child is making mistakes; and/or the parent says "no" or makes negative statements (e.g., "that's not right", "you're not right", "you can't do that") 1 or 2 times without following it by a positive statement

1 = no use of the components of 5; or the parent only makes negative statements whether they are followed by positive statements or not

d. Mutual collaboration and intersubjectivity (pursuit of shared goals)

5 = balanced speech between parent and child (i.e., parent and child make equal verbal contributions); and the parent only uses "we" statements

4 = same as 5, but the parent sometimes uses "I" or "you" statements

3 = mixed use of "we", "I", and "you" statements; and unequal verbal exchange in either direction (i.e., whether the parent talks more or less than the child)

2 = minimal verbal exchange; and the parent rarely uses "we" statements

1 = the parent only uses "I" statements; and/or there is no verbal exchange between parent and child

e. Parent's dynamic and appropriate modulation of assistance over the course of the session, withdrawal of regulatory control, and support of child's autonomy

5 = there is a clear decrease in the amount of assistance the parent provides from the beginning to the end of the task; or, there is at least no increase in the amount of assistance the parent provides from the beginning to the end of the task (i.e., the amount of assistance may stay the same if needed); and, the child is physically making more moves than the parent

3 = there is no increase or decrease in the amount of assistance the parent provides from the beginning to the end of the task

1 = amount of assistance the parent provides increases from the beginning to the end of the task to the point where the parent is doing most of the work

REFERENCES

REFERENCES

- American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders: DSM-IV-TR*. Washington, DC: Author.
- Anderson, C. A., Hinshaw, S. P., & Simmel, C. (1994). Mother-child interactions in ADHD and comparison boys: Relationships with overt and covert externalizing behavior. *Journal of Abnormal Child Psychology*, *22*, 247-265.
- Baker, J. K., Fenning, R. M., Crnic, K. A., Baker, B. L., & Blacher, J. (2007). Prediction of social skills in 6-year-old children with and without developmental delays: Contributions of early regulation and maternal scaffolding. *American Journal of Mental Retardation*, *112*(5), 375-391.
- Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, *51*, 1173-1182.
- Berk, L. E. (1986). Relationship of elementary school children's private speech to behavioral accompaniment to task, attention, and task performance. *Developmental Psychology*, *22*, 671-680.
- Berk, L. E., & Spuhl, S. T. (1995). Maternal interaction, private speech, and task performance in preschool children. *Early Childhood Research Quarterly*, *10*, 145-169.
- Berk, L., E., & Winsler, A. (1995). *Scaffolding children's learning: Vygotsky and early childhood education*. Washington, DC: National Association for the Education of Young Children.
- Campbell, S. B., Pierce, E. W., March, C. L., Ewing, L. J., & Szumowski, E. K. (1994). Hard-to-manage preschool boys: Symptomatic behavior across contexts and time. *Child Development*, *65*, 836-851.
- Corkum, P., Humphries, K., Mullane, J. C., & Theriault, F. (2008). Private speech in children with ADHD and their typically developing peers during problem-solving and inhibition tasks. *Contemporary Educational Psychology*, *33*, 97-115.
doi: 10.1016/j.cedpsych.2006.12.003

- Dawson, P., & Guare, R. (2010). *Executive skills in children and adolescents: A practical guide to assessment and intervention* (2nd ed.). New York, NY: Guilford.
- Diaz, R. M., & Berk, L. E. (Eds.). (1992). *Private speech: From social interaction to self-regulation*. Hillsdale, NJ: Erlbaum.
- Gardner, F. E. M. (1994). The quality of joint activity between mothers and their children with behaviour problems. *Journal of Child Psychology and Psychiatry*, 35, 935-948.
- Guralnick, M. J., Neville, B., Hammond, M. A., & Connor, R. T. (2008). Mothers' social communicative adjustments to young children with mild developmental delays. *American Journal on Mental Retardation*, 113(1), 1-18.
- Hill, E. L. (2004). Executive dysfunction in autism. *Trends in Cognitive Sciences*, 8, 26-32. doi: 10.1016/j.tics.2003.11.003
- Hoffman, C., Crnic, K. A., & Baker, J. K. (2006). Maternal depression and parenting: Implications for children's emergent emotion regulation and behavioral functioning. *Parenting: Science and Practice*, 6(4), 271-295.
- Holland, L., & Low, J. (2009). Do children with autism use inner speech and visuospatial resources for the service of executive control? Evidence from suppression in dual tasks. *British Journal of Developmental Psychology*, 28(2), 369-391. doi: 10.1348/026151009X424088
- Landry, S. H., Miller-Loncar, C. L., Smith, K. E., & Swank, P. R. (2002). The role of early parenting in children's development of executive processes. *Developmental Neuropsychology*, 21, 15-41.
- Lidstone, J. S. M., Fernyhough, C., Meins, E., & Whitehouse, A. J. O. (2009). Brief report: Inner speech impairment in children with autism is associated with greater nonverbal than verbal skills. *Journal of Autism and Developmental Disorders*, 39, 1222-1225. doi: 10.1007/s10803-009-0731-6
- Russell, J. (Ed.). (1997). *Autism as an executive disorder*. New York, NY: Oxford University Press.
- Schroeder, V. M., & Kelley, M. L. (2009). Associations between family environment, parenting practices, and executive functioning of children with and without ADHD. *Journal of Child and Family Studies*, 18, 227-235. doi: 10.1007/s10826-008-9223-0

- Stevens, J., Quittner, A. L., Zuckerman, J. B., & Moore, S. (2002). Behavioral inhibition, self-regulation of motivation, and working memory in children with Attention Deficit Hyperactivity Disorder. *Developmental Neuropsychology*, 21(2), 117-139.
- Vygotsky, L. S. (1962). *Thought and language*. Cambridge, MA: MIT Press.
- Vygotsky, L. S. (1987). Thinking and speech. In R. W. Rieber & A. S. Carton (Eds.), *The collected works of L. S. Vygotsky* (Vol. 1, pp. 37-285). New York, NY: Plenum. (Original work published 1934).
- Wallace, G. L., Silvers, J. A., Martin, A., & Kenworthy, L. E. (2009). Brief report: Further evidence for inner speech deficits in autism spectrum disorders. *Journal of Autism and Developmental Disorders*, 39(12). doi: 10.1007/s10803-009-0802-8
- Welsh, M. C., Pennington, B. F., & Groisser, D. B. (1991). A normative-developmental study of executive function: A window on prefrontal function in children. *Developmental Neuropsychology*, 7, 131-149.
- Whitehouse, A. J., Maybery, M. T., & Durkin, K. (2006). Inner speech impairments in autism. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, 47(8), 857-865. doi: 10.1111/j.1469-7610.2006.01624.x
- Williams, D., Happe F., & Jarrold, C. (2008). Intact inner speech use in autism spectrum disorder: Evidence from a short-term memory task. *Journal of Child Psychology and Psychiatry*, 49(1), 51-58. doi: 10.1111/j.1469.7610.2007.01836.x
- Williams, D., & Jarrold, C. (2010). Brief report: Predicting inner speech use amongst children with autism spectrum disorder (ASD): The roles of verbal ability and cognitive profile. *Journal of Autism and Developmental Disorders*, 40(7), 907-913.
- Winsler, A. (1995). The social origins and self-regulatory quality of private speech in hyperactive and normal children. *Dissertation Abstracts International Section A: Humanities & Social Sciences*. Vol 55(7-A), 1885.
- Winsler, A. (1998). Parent-child interaction and private speech in boys with ADHD. *Applied Developmental Science*, 2(1), 17-39.
- Winsler, A. (2009). Still talking to ourselves after all these years: A review of current research on private speech. In A. Winsler, C. Fernyhough, & I. Montero (Eds.), *Private speech, executive functioning, and the development of verbal self-regulation* (pp. 3-41). New York, NY: Cambridge University Press.

- 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. doi: 10.1007/s10803-006-0294-8
- Winsler, A., Diaz, R. M., McCarthy, E. M., Atencio, D. J., & Chabay, L. A. (1999). Mother-child interaction, private speech, and task performance in preschool children with behavior problems. *Journal of Child Psychology & Psychiatry*, *40*(6), 891-904.

CURRICULUM VITAE

Rebekah LaRocque was born in Richmond, Virginia. She received her Bachelor of Arts in Psychology from the University of Rochester in 2009.