

**UCLA**

**UCLA Electronic Theses and Dissertations**

**Title**

Sex differences and gendered behaviors: An analysis of school-age children and adolescents with high-functioning autism.

**Permalink**

<https://escholarship.org/uc/item/61d3g591>

**Author**

Dean, Michelle Carol

**Publication Date**

2013

Peer reviewed|Thesis/dissertation

UNIVERSITY OF CALIFORNIA, Los Angeles

Sex differences and gendered behaviors: An analysis of  
school-age children and adolescents with high-functioning autism.

A dissertation submitted in partial satisfaction of the requirements for the degree  
Doctor of Philosophy in Special Education

by

Michelle Carol Dean

2013



## ABSTRACT OF DISSERTATION

Sex Differences and gender stereotypes: An analysis of school-age children and adolescents  
with high-functioning autism

By

Michelle Carol Dean

Doctor of Philosophy in Special Education

University of California, Los Angeles, 2013

Professor Connie Kasari, Chair

This dissertation contains two studies, which are intended to expand our current knowledge about girls with ASD without intellectual disability. The first study examined sex-differences in ASD symptom endorsement and coexisting internalizing and externalizing behaviors. The second study explored the social behaviors of boys and girls with ASD at school, and the extent to which they endorsed masculine and feminine social preferences and social behaviors.

There is some literature to suggest that boys and girls differentially endorse ASD social communication deficits, repetitive behaviors and restricted interests. Additionally, girls are reported to endorse greater internalizing behaviors than boys. Yet girls with ASD without intellectual disability are underrepresented in the literature and less is known about their experiences. It is unclear how gender and the deficits associated with ASD affect the social relationships of girls and boys with ASD at school.

Thirty-eight girls with ASD were matched by age ( $\mu = 9.97 (3.86)$ ), grade, IQ ( $\mu = 93.29 (13.34)$ ), and city of residence to boys with ASD. In the first study, between-group comparisons of IQ, the deficits associated with ASD, and internalizing and externalizing behaviors were examined. The second study used mixed methods analysis to examine participant observation field notes and to explore the social characteristics of boys and girls with ASD at school during unstructured social periods.

In the first study, differences in IQ and ASD symptom endorsement were not detected, however, the findings indicated that both parents and teachers report that girls with autism endorse greater internalizing symptomology than boys with ASD.

In the second study, gender differences were also detected in the observed social characteristics and behaviors of children with ASD. Both boys and girls with ASD primarily engaged in same-gender play and socializing activities when hanging out at school. Within the ASD sample, girls with ASD made more social initiations and were more persistent in gaining access into peer groups compared to boys with ASD. Boys with ASD spent more time alone and rejected more social initiations compared to girls with ASD. The challenges associated with ASD were more difficult to detect in girls than in boys. Modifications to social skills interventions at school are needed to better address the environmental factors that influence the social behaviors of boys and girls with ASD.

The dissertation of Michelle Carol Dean is approved.

Sandra Graham

Sheryl Kataoka

Lois Weinberg

Jennifer Symon

Connie Kasari, Committee Chair

University of California, Los Angeles

2013

## TABLE OF CONTENTS

LIST OF FIGURES.....	vi
INTRODUCTION.....	1
Theoretical Models.....	5
SEX DIFFERENCES IN ASD.....	7
GENDERED BEHAVIORS IN ASD SAMPLE.....	20
CONCLUSION.....	49
REFERENCES.....	60

## LIST OF TABLES, FIGURES, & APPENDIX

1. Table 1. Descriptive statistics and non-significant site differences on the primary outcome variables.....	51
2. Table 2. ANOVA tests of gender differences in ASD symptom endorsement .....	52
3. Table 3. Parent and teacher reports of internalizing and externalizing behaviors: Mean scores (standard deviations).....	53
4. Table 5. Descriptive statistics: Mean scores (standard deviations) of social group structure, social activity, and conversation scores.....	54
5. Figure 1. Example of gendered social behavior coding for one observation interval.....	55
6. Figure 2. The games that elementary school children played at school.....	56
7. Figure 3. The unstructured activities that boys and girls with and without ASD played at school.....	57
8. Appendix: Gender coding: Operationalized terms, definitions and examples.....	58



## Acknowledgement

I would like to thank Connie Kasari for her advisement and mentorship, and for providing me with the opportunity to work on her projects. I would also like to express my gratitude to my dissertation committee and the graduate students and research assistants who helped me to complete this study. I am grateful to Kate Riedell, Paulina Ong, and Marta Wirga for coding the data, and many thanks to Wendy Shih for statistical advice and consultation. I would like to thank the Autism Intervention Research Network for Behavioral Health (AIR-B), particularly Connie Kasari, Catherine Lord, Rebecca Landa, Felice Orlich, and the United States Department of Health and Human Services for allowing me to use their data. Finally, I am grateful to my husband, Eric Lorenzini, and my UCLA cohort for their inspiration and continued support.

## CURRICULUM VITAE

---

### EDUCATION

- 2013** M.A. Education University of California, Los Angeles  
Master's Thesis: Girls with autism: Do they fit in?  
Committee chair: Connie Kasari, Ph.D.
- 2008** M.A. Special Education California State University, Northridge  
Graduate project: Stress management for parents of children with disabilities  
Advisor: Ivor Weiner, Ph.D.
- 2007** Clear teaching credential California State University, Northridge  
Special education Mild to moderate
- 

### RESEARCH EXPERIENCE

- Fall 2012-Present** Project Coordinator, Autism intervention research network:  
*Supervisor:* Connie Kasari, Ph.D., UCLA  
*Duties:* Write university and school district IRB and memorandum of understanding, recruitment, manage data, preliminary qualitative and statistical data analysis, train and mentor new graduate students, assessment, collaborate with partnering school sites and partnering research sites, write focus group and key informant interview script, facilitate focus groups and key informant interviews
- Spring 2011-Present** Project Coordinator, The Study of Peer Relationships in Schools  
*Supervisor:* Connie Kasari, Ph.D., UCLA  
*Duties:* IRB, Recruitment, assessment, data management, write IRB, clinical social skills intervention with adolescents with autism, preliminary statistical data analysis, contribute to written publications, train and mentor graduate students and research assistants, collaborate with school personnel.
- Fall, 2009-Present** Graduate Student Researcher  
*Supervisor:* Connie Kasari, Ph.D., UCLA  
*Duties:* Recruitment, assessment, clinical social skills intervention with elementary school children with autism, clinical supervisor for interventionist training, data management, preliminary statistical analysis
- 

### PUBLICATIONS

Dean, M., Fox, G. A. & Kasari, C. (2013). How narrative difficulties build peer rejection: A case study of a girl with Asperger's syndrome and her female peers. *Discourse Studies*, 147-166.

Dean, M., Kasari, C., Landa, R., Lord, C., Orlich, F., Harwood, R. (in submission). The peer relationships of girls with ASD at school: Comparisons with boys and girls with and without ASD

---

## PRESENTATIONS

Dean, M., Kasari, C., Landa, R., Lord, C., Orlich, F., Harwood, R. (2013). The friendship quality of girls with autism at school: Comparisons with boys with autism and typically developing boys and girls. Society for Research in Child Development (SRCD), Poster presentation.

Sterling, L., Dean, M., Kasari, C., Orlich, F., Lord, C. (2013). The effects of school-based social skills intervention on self-report of depressive symptoms in youth with autism spectrum disorders. Society for Research in Child Development (SRCD), Poster presentation.

Burner K., Dean, M., Montague, R., King, B., Kasari, C., and Orlich, F., (2013). The friendship quality of girls with ASD at school: Comparisons with boys with ASD and typically developing girls and boys. Society for Research in Child Development (SRCD), Poster presentation.

Dean, M., Kasari, C., Landa, R., Lord, C., Orlich, F., Harwood, R. (2012). The peer relationships of girls with ASD at school: Comparisons with boys and girls with and without ASD International Society for Autism Research (IMFAR), Poster presentation.

Dean, M. & Mahjouri, S. (2011). Social preference in children with autism spectrum disorders, International Society for Autism Research (IMFAR), Poster presentation.

Fox, G. A., Dean, M. & Kasari, C. (2011). How narrative difficulties build peer rejection: A case study of a girl with Asperger's syndrome and her female peers, International Society for Autism Research (IMFAR), (2011), Poster presentation.

---

## TEACHING AND WORK EXPERIENCE

### 2009 - 2012

Professor, Educating Students with Autism; Research Studies in Special Education  
California State University, Los Angeles  
*Supervisor:* Lois Weinberg, Ph.D. Andria Zetlin, Ph.D., Diane Fazzi, Ph.D.  
*Duties:* Create PowerPoint, lectures, and class activities; design syllabus, and assessment, facilitate group discussions and collaborative activities design syllabus, and develop assessment

## Introduction

Since children with autism spectrum disorders (ASD) without intellectual disability are often educated in the general education setting, schools provide a relevant context to examine sex and gender in ASD populations. Starting in preschool and persisting through adolescence, sex is an extremely powerful predictor of children's social organization. Typically developing boys and girls naturally segregate into same-sex peer groups (Maccoby, 1990; Maccoby, 1999; Maccoby, 1988), and qualitative differences in the ways that boys and girls socialize are widely recognized (Corsaro & Eder, 1990; Goodwin, 2006; Pellegrini, Kentaro, Blatchford, & Bains, 2004). Gender identity becomes more pronounced in school environments, especially in same-sex peer groups (Maccoby, 1988). With rare exceptions, children with ASD have the same physical sex traits as typically developing populations. Therefore, it is conceivable that social gender biases shape how ASD symptoms are endorsed by children and how those symptoms are tolerated and perceived by others.

There is some evidence that certain behavioral symptoms of ASD manifest differently in girls than in boys (Carter, 2007; Hartly & Sikora, 2009). Yet a distinctly male or female ASD profile has not been identified. In contrast, sex differences in typically developing populations have been reported in social, cognitive, and psychological domains. Most notably, studies used the terms "masculine" and "feminine" to describe certain male and female play preferences and social behaviors (Jordan-Young, 2010; Knickmeyer, Wheelwright, & Baron-Cohen, 2007; Maccoby & Jacklin, 1974; Maccoby, 1999).

For purposes of this study, I will use Jordan-Young's (2010) definitions of the terms "sex" and "gender." Sex refers to male or female biological traits. Gender describes psychological characteristics and social behaviors that are perceived as either masculine or feminine. While masculine behaviors are primarily associated with boys, and feminine

behaviors with girls, some children have cross-sex gender profiles. A common example of this phenomenon is a “tomboy,” a female who is described by her stereotypically masculine social preferences (Maccoby, 1999; Maccoby & Jacklin, 1974). The use of operationalized sex and gender definitions in this study is not intended to promote a social agenda or to perpetuate gender stereotypes. Instead, the terms are used to measure the presence of gender stereotypes, in an effort to contribute to our awareness of issues relating to girls with ASD.

It is believed that ASD is biologically based and that ASD, or the propensity to develop ASD, is present at birth; however, ASD is not recognizable through physical traits. Instead, ASD is diagnosed through observations of psychological attributes and behaviors. One theory suggests that girls with ASD have a “male brain” and will therefore endorse masculine play styles and preferences (Baron-Cohen, 1999). In contrast, a theoretical assertion from the literature on typically developing children suggests that masculine and feminine behaviors are environmentally shaped according to sex labeling at birth (Maccoby, 1988). To date, no studies have examined how environmental contexts shape the endorsement of gendered behaviors in ASD populations. If some behaviors are considered more acceptable in boys than in girls, then implicit gender biases may mask our recognition of ASD-symptom endorsement. Then, like the social behaviors in typically developing populations (Maccoby, 1988), adults may differentially reinforce behaviors of ASD in girls compared to boys.

### **Girls with ASD**

Most of what we know about school-age children with ASD without intellectual disability comes from studies with largely male samples (Chamberlain, Kasari, & Rotherman-Fuller, 2007; Kasari, Chamberlain, & Bauminger, 2001; Rotheram-Fuller, Kasari, Chamberlain, & Locke, 2010). Given that girls with ASD show impairment in the same core

deficits as boys with ASD (Lord, 1997), they are bound to share similar characteristics. But girls with ASD are also similar in many respects to typically developing girls. Girls with ASD without intellectual disability are a minority within their disability and within their gender. Due to the paucity of research about this population, it is unclear if school-age girls with ASD endorse ASD behaviors similar to boys, if there is a female prototype of ASD, or if cultural biases shape the way girls endorse their ASD symptoms (Wing, Gould, & Gillberg, 2011).

Despite being associated with a more severe profile, girls are diagnosed with ASD significantly later than boys (Begeer et al., 2013; Shadduck et al., 2009), and often after receiving multiple misdiagnoses (Kopp & Gillberg, 1992). To date, the most widely reported sex difference in ASD is that males are diagnosed with ASD at a rate of 4.1 times the rate of females (Fombonne, 2003, 2009; Lord & Schoopler, 1985). Girls diagnosed with ASD also have disproportionately higher rates of intellectual disability, with a median boy-girl sex ratio of 1.95:1 in the intellectually disabled range (Fombonne, 2003, 2009) compared to 8.8:1 in the population of children with ASD with an IQ over 70 (Fombonne, 2009; Volkmar et al., 1993). Consequently, girls with high-functioning ASD receive access to special education services significantly later than girls with ASD with intellectual disability and boys with ASD of all intellectual levels (Shadduck et al., 2009).

There are no definitive explanations for the underrepresentation of girls with high functioning ASD. Some evidence suggests a male bias in our current understanding of ASD (Kopp & Gillberg, 1992; Shadduck et al., 2009), or that the less-frequently-affected sex will be more severely impacted (Tsai, Stewart, & August, 1981). Whether or not evidence continues to support these explanations, higher-functioning girls with ASD exist and are marginalized in our current practices. Therefore, more research is needed to examine the

behaviors of girls with ASD, and to consider social biases that mask our ability to recognize and attend to their plight.

Examining a wider range of disabilities highlights the historic underrepresentation of girls with disabilities in special education programs (Dhuey & Upscomb, 2010), suggesting that girls with ASD are following the same trend. Prior studies examining the overrepresentation of boys in special education indicate that sex is a salient predictor for special education referral and subsequent diagnoses (McIntyre & Tong, 1998; Gregory, 1977); boys are twice as likely to receive special education services (Arms, Bickett, & Graf, 2008). As such, girls with disabilities are at risk for having unmet service needs (Bussing, Zima, Perwien, Belin & Widawski, 1998), and negative outcomes (Arms et al., 2008). Therefore, in order to better identify and address the needs of girls with ASD, we need more research that focuses on similarities and differences in school-age populations.

A bias in teachers' understanding of disability has been identified as a factor that contributes to underrepresentation of girls with disabilities in special education programs (Stinnett, Bull, Koonce, & Aldridge, 1999). Boys, who are typically associated with more externalizing and disruptive behaviors, are significantly more likely to be referred for special education evaluation (Dhuey & Lipscomb, 2010). Because girls are typically associated with internalizing behaviors, compliant girls with learning difficulties are easier to tolerate and to overlook (Arms et al., 2008). However, research indicates that even when girls endorse "male-like" behaviors, they are still significantly less likely to be referred for a special education assessment, or to receive access to services (Coles, Slavec, Berstein, & Baroni, 2012; Russo, 2001). This indicates that gender biases persist even when the behaviors of boys and girls are similar. If gender biases skew perceptions of behaviors in ASD populations, it could be more difficult to recognize when girls have ASD behaviors.

Therefore, a closer analysis of girls with ASD in schools may provide a more accurate understanding of sex differences in the endorsement of ASD symptomology.

### **Theoretical Models**

**Brain differences model.** Baron-Cohen (1999) developed the extreme male brain theory (Baron-Cohen, 1999) to help explain the disproportionate representation of boys within the high-functioning ASD population. Influenced by the brain-organization theory, the extreme male brain theory assumes sexual dimorphism in cognition and behavior, and the theory links prenatal androgen exposure to the development of masculine and feminine traits. Baron-Cohen supported the theory by identifying gender profiles in a sample of typically developing men and women. Men evidenced strength in systemizing and women in empathizing (Baron-Cohen & Wheelwright, 2004). When people with ASD were surveyed they had a propensity to endorse an extreme masculine/systemizing profile. While women with ASD were included in the study, gender differences within the ASD population were not reported.

Social interests and gender preference measures have been used to understand the relationship between hormone exposure and the biological underpinnings of masculine or feminine behaviors (Jordan-Young, 2010). Several studies examined the interests and social preferences of girls with congenital adrenal hyperphasia (CAH) whose bodies, due to their disorder, produce more androgen than typically developing girls (Berenbaum & Resnik, 2007, Ehrhardt & Bajer, 1974; Servin, 2003). Results indicated that girls with CAH evidenced masculine characteristics and preferred male-typical games and activities (Berenbaum & Resnik, 2007) and male playmates (Servin, 2003). According to extreme male brain theory, if girls with ASD have more exposure to androgen in their prenatal development, then they should evidence a masculine profile.



Knickmeyer, Wheelwright and Baron-Cohen, (2007) tested the prenatal androgen hypothesis by examining play behaviors and preferences in girls with ASD. Based on the studies of girls with CAH, it was predicted that girls with ASD would be less interested in feminine play items or pretense compared to male or gender neutral play items. The results of this study partially supported the hypothesis. Boys with ASD showed a strong preference for male items and a slight preference for male pretense. Girls with ASD preferred non-sex play items. Contrary to expectations, girls with ASD preferred female pretense. These findings suggest that both sex and ASD contribute to the play preferences of girls with ASD, and that using dimorphic descriptions of the male and female brain limits our understanding of girls with ASD.

**Socialization-Personality Perspective.** According to Maccoby (1988), being born a boy or a girl influences parents' child-rearing practices and children's interactions with their environment. By age four, children begin to self-identify as a boy or a girl (Maccoby, 1988), and society encourages the use of culturally appropriate masculine or feminine behaviors throughout development. Consequently, girls begin to act more like other girls than like boys, and there are greater differences in social behaviors across gender than within gender (Maccoby, 1988).

Given the importance of gender in school-age typically developing populations, the lack of studies regarding the relationship between gender and ASD in school-age populations limits our current understanding of ASD in high-functioning girls. The school environment has many opportunities to prepare youngsters for adulthood. Therefore, more information is needed to understand how the core deficits of ASD interact with the environment and to identify differences in boys' and girls' experiences.

## Study 1: Sex Differences in ASD

### Background

A body of empirical findings has identified similarities in the ways that boys and girls endorse symptoms of ASD (Lord, 1983; Pilowsky, Yirmiy, Shulman, & Dover, 1998; Volkmar, Szatmari, & Sparrow, 1993). However, certain methodological procedures seem to mask differences in the ASD profile of boys and girls in samples with wide-ranging IQ scores (Volkmar, Szatmari, & Sparrow, 1993). More recently, subtle sex differences were identified in the cognitive, behavioral, and emotional profiles of toddlers with ASD (Carter, 2007; Hartly & Sikora, 2009). In the existing literature, few studies have examined sex differences in ASD symptom endorsement in school-age populations in the higher-functioning range. More research is needed to determine if differences persist throughout development.

Matching boys and girls with ASD by visual reception scores (Carter et al., 2007) indicated that, instead of having a more impaired profile, girls with ASD had a *different* developmental profile than boys. Toddlers of both sexes with ASD presented relative strength in visual reception and fine motor skills, however, there were significant sex differences in the verbal and nonverbal cognitive domain. Boys achieved higher language composite scores and girls out-performed boys on the visual reception measures. Follow up comparisons, using age as a covariate, identified male strength in the domain of motor functioning and slight trends of male strength in fine motor functioning, receptive language, and expressive language.

**Social communication profiles.** Several studies identified sex differences in the social and communication profiles of young children with ASD (Kopp & Gilberg, 1992).

Carter et al. (2007) identified significant male strength in the area of expressive language and a trend-level strength in receptive language. Parent reports indicated that girls had lower empathy scores and were significantly less socially competent than boys. Similarly, when Hartly and Sikora (2009) matched boys and girls with ASD by receptive language scores, they found that girls with ASD had significantly greater social-communication impairment.

In contrast, more recent findings were unable to detect sex differences in social communication (Solomon, 2012). Another study found that girls with ASD are more proficient with social communication (Lai et al., 2011). Clinical reports describe girls with ASD as being more interested in socialization, and therefore better at masking their social communication deficits (Atwood, 2007). Because language demands on girls and boys are different (Maccoby, 1999; Maccoby, 1988; Maccoby & Jacklin, 1974), it is possible that different social expectations are placed on girls with ASD than on boys with ASD. Therefore, more research is needed to evaluate sex differences in social communication in school-age populations with ASD without intellectual disability and to determine if the impact of language deficits differs as a result of one's gender.

**Restricted interests and repetitive behaviors.** Differences in restricted interests and repetitive behaviors were identified between boys and girls with ASD, with boys evidencing significantly more repetitive behaviors than girls (Bolte, Duketis, Poustka, & Holtmann, 2011; Hartly & Sikora, 2009). More recently, Sipes, Matson, Worley, and Kozlowski (2011) identified differences between boys and girls, however, the differences were greater in higher functioning groups. By categorizing 390 toddlers (17-36 months) by sex and developmental levels, females in the high-functioning range had significantly fewer restricted interests and repetitive behaviors than females in the lower-functioning group and males in both groups.

Mandy, et al. (2011) examined parents' reports of the restricted interests and repetitive behaviors in school-age children and adolescents with ASD (16 girls; 97 boys) and with Pervasive Development Disorder – Not Otherwise Specified (PDD-NOS; 23 girls; 95 boys). Parents reported that boys were more likely to line up toys or insist on formal play routines, which are behaviors that are typically associated with ASD. Bolte, Duketis, Poustka & Holtmann (2011), examined sex differences in the executive functioning of people with ASD, focusing on attention to detail and shifting focus from one task to the next. Males had superior attention to detail compared to females, which suggests a hyper-systemizing trend within the ASD sample. Females with ASD demonstrated relative strength in cognitive flexibility, which was also associated with fewer repetitive behaviors.

While the findings described above indicate differences in repetitive behaviors of boys and girls, female endorsement of repetitive behavior has been difficult to detect using quantitative methods (Bolte, Duketis, Poustka, Holtmann, 2011; Hartly & Sikora, 2009). Qualitative depictions of the repetitive behaviors and restricted interests in girls with ASD suggest a possible male bias in our current beliefs. Girls with ASD have been associated with higher rates of repetitive question-asking (Carter, 2007; Kopp & Gillberg, 1992), repetitive demanding (Kopp & Gilberg, 1992), and failing to synchronize to group social norms because of a strict adherence to restricted interests (Dean, Adams, & Kasari, 2013). In contrast to previously reviewed quantitative findings, girls with ASD have been described as having more difficulties with completing tasks than boys because they are consumed with compulsive routines and rituals (Kopp & Gilberg, 1992, Kopp & Gillberg, 2011).

Clinical reports suggest that girls with ASD endorse social behaviors that mask social deficits, repetitive behaviors, and restricted interests (Atwood, 2006; Kopp & Gilberg, 1992). Observations revealed that girls with ASD fixated on a person of interest and mimicked

social behaviors (Atwood, 2006; Kopp & Gilberg, 1992). By copying others' social behaviors, girls with ASD appeared more socially competent than they actually were. But the girls lacked interpersonal awareness and a deeper understanding of social context. Also, girls' use of repetitive behaviors that are not typically associated with ASD makes it difficult for professionals to properly diagnose and support them. Consequently, more research is needed to investigate the manifestation of restricted behaviors in higher functioning girls with ASD.

**Comorbid symptomology.** Studies have identified differences between boys and girls in the occurrence of co-morbid conditions including internalizing and externalizing symptomology. In a sample of toddlers with ASD, Carter et al. detected trend-level differences favoring girls in the areas of depression and social withdrawal. Likewise, Hartly and Sikora (2009) examined the developmental profiles of 199 toddlers and found that girls endorsed significantly higher symptoms of anxiety and depression and were significantly more likely to have sleep problems.

There is conflicting evidence in the recent research examining older populations of boys and girls who are diagnosed with ASD without intellectual disability. Both boys and girls with ASD endorse greater internalizing and externalizing behaviors than the typically developing control groups, however, within-group differences were not significant (Kozlowski, Matson, & Rieske, 2012; Mazurek, & Kanne, 2010). In contrast, when Solomon et al. (2012) matched a sample of girls with ASD by IQ to boys with ASD and typically developing boys and girls (ages 8-18), significant differences in parent reports of internalizing behaviors were identified. Girls with ASD were at a greater risk of internalizing psychopathology than boys with ASD and typically developing girls. To date, parents have

been the primary reporters of internalizing and externalizing behaviors. More research is needed to determine whether or not teachers also detect these differences at school.

A meta-analysis identified behaviors associated with students with ASD that are most commonly targeted for classroom intervention. Clinicians and teachers report the least tolerance for shouting, stereotypy, noncompliance, and aggression (Machalick, O'Reilly, Beretvas, Sugafos, & Lancioni, 2007). If girls with ASD are prone to internalizing behaviors, their maladaptive behaviors may be a low priority for teachers. On the other hand, it is unclear if teachers' perceptions of ASD-externalizing behaviors are different for girls than for boys. One gap in the existing literature is whether teachers view girls with ASD differently than they view boys with ASD.

Robertson, Chamberlain and Kasari (2003) reported that general education teachers generally had favorable attitudes towards students with ASD, although teachers were less positive towards students with more severe behaviors. Teachers' perceptions of the classroom behaviors of typically developing children are strongly related to a child's adjustment, classroom engagement, academic achievement, and acceptance by peers (Griggs et al., 2009). Children with high rates of inattention and distractibility and low rates of classroom engagement are significantly more likely to be rated negatively by their teachers (Griggs, 2009).

While teacher biases have not been discussed in the ASD literature, teacher biases have been reported in ADHD populations. These findings indicated that girls with ADHD were more likely to be rated as inattentive, while boys were considered more impulsive (Newcorn et al., 2001). Given that girls with ASD have been reported as endorsing greater internalizing behaviors than boys with ASD (Carter, 2007; Hartley & Sikora, 2009), it is possible that teachers' perceptions of girls with ASD are similar to their perceptions of girls

with ADHD. Because internalizing behaviors tend to be under-reported by teachers (Youngstrom, Loeber, & Stouthamer-Loeber, 2000), the emotional challenges of females with ASD may go unrecognized. To address this gap in the research, perspectives from multiple informants and across different settings may be more effective in detecting when the behavioral profiles of girls with ASD manifest differently than those of boys.

The purpose of the following study is to contribute to the existing literature by examining sex differences in ASD symptom endorsement and coexisting internalizing and externalizing behaviors. The current study is a secondary analysis of data collected during a multi-site randomized controlled trial. The first hypothesis predicts that girls will endorse greater social communication impairment and greater internalizing behaviors than boys, with older girls exhibiting greater impairment than younger girls. The second hypothesis predicts that boys will endorse higher repetitive behaviors and restricted-interest scores, and greater externalizing behaviors than girls.

## Methods

**ASD Sample.** Due to the small number of girls with ASD that are typically represented in research samples, data from all girls in the data set (n=38) were selected for the current study (AIR-B project, 2012). In the original study, the ratio of male participants to female participants follows epidemiological reports (4-8:1), therefore data from all males that meet the study criteria were considered. The male sample (n=38) was randomly selected from the pool of participants to match girls by age, grade, IQ, and city of residence to the female participants. Randomly selecting the male group controlled for the potentially confounding effects of school and site differences.

The current study is a secondary analysis of a randomized controlled trial and is unrelated to the previous studies from which the data were drawn. The selected data were

part of a larger multisite study in four different US states (Los Angeles, Seattle, Anne Arbor, and Baltimore). A one-way ANOVA was used to test site differences on the primary outcome variables. The findings were non-significant; therefore, site was not included in the following analyses (Table 1).

The participants in this study were in elementary school (grades 1-5), middle school (grades 6-8), and high school (grades 9-12). To meet criteria for this study, children and adolescents with ASD had to be without intellectual disability ( $IQ \geq 70$ ; confirmed by the Stanford-Binet Fifth Edition) and educated in the general education classroom for a minimum of 80% of the school day. The diagnosis of ASD was confirmed using the Autism Diagnostic Observation Schedule (ADOS; Lord, Rutter, Dilavore, & Risi, 2002) and The Social Communication Questionnaire (SCQ; Rutter, Bailey & Lord, 2008).

## **Measures**

**Social communication and restricted interests and repetitive behaviors.** The Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2002) was used to confirm diagnosis of ASD. It is a standardized, semi-structured play-based assessment of autistic symptoms. There are four modules based on expressive language ability (Lord, 2000). The ADOS algorithms for the domains of social communication and restricted interests and repetitive behaviors were assessed. Items within each domain were scored based on a three-point scale (0 = no impairment to 2 = marked impairment) and summed. The ADOS has excellent reliability for distinguishing between children with and without ASD and among the classification categories within the autism spectrum. In this study, elementary, middle and early high school (9<sup>th</sup> and 10<sup>th</sup> grade) students were administered module 3. Older high schools students were administered module 4. To account for differences between modules in



the number of items, items within domains were summed and divided by total number of items in the domain.

The Social Communication Questionnaire (SCQ; Rutter et al., 2008), is an assessment used to screen for the presence of ASD symptoms. Parents complete a 40-question survey about their child's developmental history, resulting in a total score that reflects ASD characteristics and symptomology. The SCQ scores can be used to compare groups.

**Cognitive ability.** Stanford-Binet Intelligence Scale: Fifth Edition (SB-5). The SB-5 is a standardized test that measures intelligence and cognitive abilities in children and adults. For this study, an IQ score was determined from an abbreviated version using two subtests, yielding an abbreviated non-verbal and verbal IQ score. The abbreviated IQ scores are highly correlated with full-scale IQ scores. The SB-5 has high reliability.

**Parent measures.** The Behavior Assessment System for Children–Parent Rating Scales for Children and Adolescents (BASC; Reynolds & Kamphaus, 1992) is a nationally standardized measure with high reliability and validity scores (Sandoval & Echandia, 1994). Parents rate the presence of adaptive and problem behaviors observed in the home and in community settings on a 4-point Likert type scale (0 = never – 3=almost always). The 130-160 question survey yields 9 problem behavior scales, 4 adaptive skills scales, and summary (composite) scores. Standard scores with a mean of 50 and a standard deviation of 10 are used to describe children and adolescent clinical profiles and the presence of coexisting conditions. For this study, internalizing and externalizing composite scores within the clinical scale composite were examined. The internalizing composite scores were derived from three subscales: anxiety, somatization, and withdrawal. The externalizing composite scores were derived from aggression, hyperactivity, and conduct problems.

**Teacher measures.** The Behavior Assessment System for Children–Teacher Rating

Scales for Children (BASC TRS-C; Reynolds & Kamphaus, 1992) is a nationally standardized measure with high reliability and validity scores (Sandoval & Echandia, 1994). Teachers rate the frequency and adaptive behaviors on a 4-point Likert type scale (0 = never – 3 = almost always). The 139-question survey yields 9 problem-behavior scales, 4 adaptive skills scales, and summary (composite) scores. Standard scores with a mean of 50 and a standard deviation of 10 are used to describe children's behavioral adjustment. For this study, the Internalizing and Externalizing Problems Composite were used as a measure of children's coexisting conditions. To address our first research question, internalizing and externalizing subscales were used. Internalizing problem behavior consists of anxiety, depression, and somatization. It evidences an internal consistency reliability of .91. The externalizing composite consists of the Aggression, Hyperactivity, and Conduct Problems subscales.

### **Analysis**

Multiple measures were used to evaluate the cognitive, behavioral, and ASD profile for children and adolescents with ASD. Descriptive statistics and the results from ANOVA tests are shown in table 2. The primary outcome variables (ADOS social communication and restricted interests and repetitive behavior scores, composite scores from the SCQ, and Stanford-Binet scores including non-verbal IQ, verbal knowledge, and abbreviated IQ) were entered into the model as dependent variables. Gender was entered as the independent variable. Because of the wide age range of the sample, age was entered into the model as a covariate.

Results indicated that there were no significant between-group differences, corroborating previous findings that examined sex-differences in high-functioning ASD populations (Volkmar, 1993). When I controlled for IQ score, no significant between group differences were detected on diagnostic and IQ measures.

## **Internalizing and externalizing behaviors**

Gender differences in parent and teacher reports of internalizing and externalizing behaviors were assessed using a repeated-measures ANOVA test with gender as the fixed factor and parent-and-teacher internalizing or parent-and-teacher externalizing scores (BASC internalizing/externalizing composite scores) as the repeated factor. The mean scores and standard deviations of internalizing and externalizing composite scores for the male and female sample are shown in table 2.

Using internalizing behaviors as the repeated factor, the results of a repeated measures ANOVA model indicate that that within-group effect of reporter (parent or teacher) on internalizing scores was not significant ( $F = (1,52) .66, p > .42, \eta_p^2 = .01$ ). Between group comparisons found significant effects of gender ( $F = (1,62) 6.85, p > .01 \eta_p^2 = .01$ ), indicating that both parents and teachers report that girls with ASD exhibit greater internalizing behaviors than boys with ASD.

Using parent-rated and teacher-rated externalizing composite scores as the repeated measure, the results indicate that the within-group effect of reporter (parent or teacher) on externalizing behaviors was not significant ( $F (1,53) = .09, p > .09, \eta_p^2 = .01$ ). Between-group comparisons show that the effect of gender was not significant ( $F (1,53) = .002, p > .96, \eta_p^2 = .01$ ) indicating that parents and teachers do not report gender differences in externalizing behaviors.

## **Discussion**

The primary aim of this study was to explore gender differences in ASD symptom-endorsement and co-morbid symptomology in school-age populations. The findings of the current study are consistent with prior research that used similar matching procedures and

measurements in a smaller sample of school-aged children and adolescents with ASD without intellectual disability (Solomon et al., 2012).

Significant differences in social communication scores were not detected, indicating that social communication deficits of the girls in this sample were similar to boys with ASD. In previous studies that identified sex differences in social communication, the samples were younger and included children with and without intellectual disability (Carter, 2007; Hartley and Sikora, 2009). These results are consistent with recent reports that examined sex-differences in school-age populations without intellectual disability (Solomon et al., 2012). The current findings build on our existing knowledge by examining a slightly younger population of children with ASD. More research is needed, however, to examine how social communication deficits exist in real-life social situations at school.

Analysis of the current sample did not detect sex-differences in restricted interests and repetitive behaviors. In prior studies, sex-differences in parent-reported restricted interests and repetitive behaviors appear more pronounced in younger populations (Carter, 2007; Hartley and Sikora, 2009). In older populations of students, however, significant differences have been described as marginal (Solomon, 2012). While the ADOS is a standardized assessment that is considered the “gold standard” for autism diagnosis, it is still subject to clinical judgment. Given that girls with ASD have recently been receiving more empirical attention, it is possible that clinicians may have become better able to detect the restricted interests and repetitive behaviors of girls with ASD.

Significant gender differences were identified in parent and teacher reports of internalizing behaviors. These findings corroborate and build on the previous studies that identified more severe internalizing psychopathology in girls with ASD compared to boys with ASD and typically developing girls. This study contributes to the exiting literature in

two ways. Previous findings were based on parent reports. The findings in the current study are the result of parent and teacher reports, indicating that girls with ASD endorse higher internalizing behaviors across multiple settings (home and school) and reporters (parent and teacher). Thus, the results of this study fill a gap in our existing knowledge, and highlight potential areas for early intervention in schools.

Both teachers and parents reported that girls with ASD endorsed internalizing symptomology within the “at risk” range. As would be expected in typically developing populations, girls endorsed greater internalizing behaviors than boys (Rose & Rudolph, 2006). Given the social deficits associated with ASD, this can pose unique challenges for girls on the spectrum. In typically developing populations, girls use social coping strategies, which serve as protective buffers against emotional problems (Rose & Rudolph, 2006). By talking about their feelings with their friends, typically developing girls can mitigate the potentially negative effect of internalizing behaviors on their adjustment. If the social deficits associated with ASD preclude girls with ASD from engaging in intimate exchanges and make them unable to share their experiences or talk about their feelings with their friends, their struggles may be overlooked and left untreated. Consequently, more research is needed to examine how increased internalizing symptomology affects the social development of girls with ASD and the risk of maladjustment and negative long-term outcomes.

In contrast, neither parents nor teachers reported differences between boys and girls with ASD in externalizing behaviors. In typically developing populations, boys have been associated with greater externalizing behaviors (Rose & Rudolph, 2006), and girls who endorse externalizing behaviors are associated with maladjustment and lower achievement (Crick, 1997). Moreover, children exhibiting more severe externalizing behaviors are at a greater risk of antisocial psychopathology. Given the social challenges associated with ASD,

girls with ASD who endorse levels of externalizing symptomology similar to boys may be perceived as violating gender norms, thus putting them at a greater risk than boys with ASD for victimization and alienation (Crick, 1997). Therefore, more research is needed to examine the long-term effects of externalizing behaviors on girls with ASD.

Prior research indicated that teachers are least tolerant of students with ASD who have externalizing behaviors (Machalick, O'Reilly, Beretvas, Sugafos, & Lancioni, 2007). Both the boys and girls with ASD in the current sample fell within the average range of externalizing symptomology, and therefore exhibited behaviors that were similar to what would be expected in typically developing populations. More research is needed to determine if teachers inflate the occurrence of externalizing behaviors in girls and boys with ASD compared to their typically developing classmates.

While the current study builds on our understanding of sex-differences in school-age populations of children with ASD without intellectual disability, there are several limitations to this research. First, parent and teacher demographic information was not available for all participants in the study. More research is needed to examine the relationship between parent and teacher characteristics and their reports of child behaviors. Second, this study did not account for the cultural diversity within the sample. To date it is unclear if the symptoms associated with ASD are perceived as more or less impaired in different cultures. Future research is needed to account for different cultural expectations, and for the possibility that social communication deficits, internalizing behaviors or externalizing behaviors may be seen as more acceptable in certain communities than others.

## **Study 2: Gendered Behaviors in ASD Sample**

### **Background**

In schools, social relationships are developed in the classroom, in unstructured social environments, and on the playground through participation in games and activities (Blatchford, Baines, & Pellegrini, 2003). We know that children with ASD often remain at the periphery of social groups and are isolated during play (Bauminger & Shulman, 2003; Chamberlain, Kasari, & Rotherman-Fuller, 2007). However, less is known about how the sex of children with ASD affects their social behaviors in a natural setting. Because typically developing boys and girls socialize differently (Maccoby, 1988), with verbal interactions being more important in female relationships, the language deficits associated with ASD may be more detrimental to girls than to boys. A closer inspection of how girls and boys with ASD behave in a natural environment is needed to identify underlying mechanisms that lead to lower social status.

Students with autism in general education classrooms evidence lower social status, and fewer reciprocal friendships than their typically developing peers (Chamberlain, Kasari, & Rotherman-Fuller, 2007). Having limited social experiences, children with ASD have fewer opportunities to practice and develop social skills (Bauminger & Kasari, 1999). When children with ASD do have friends, the friendships are not as stable and are less intimate compared to those of typically developing classmates (Bauminger & Kasari, 2000; Bauminger & Shulman, 2003). Children with ASD report higher levels of loneliness than their classmates (Bauminger & Shulman, 2003), and these feelings become more severe during adolescence (Locke, 2010) and adulthood (Howlin & Mawhood, 2000).

Social incompetence in schools is associated with negative long-term outcomes. Buhs, Ladd, and Herald, (2006) followed 380 children from kindergarten through fifth grade

and identified patterns in abuse, exclusion, and classroom achievement. Children who were highly abused and chronically excluded by their classmates in kindergarten through fourth grade were more likely to be abused or excluded by their peers in fifth grade. Chronic peer abuse was also associated with school avoidance, chronic exclusion, and classroom disengagement. Both aggressive and withdrawing behaviors were associated with chronic exclusion. Therefore, if girls with ASD have more internalizing behaviors than boys, the cause of their lower social status may be different than boys with ASD with externalizing behaviors.

The literature on girls with ASD presents two different points of view. Since girls with ASD in younger populations evidence greater internalizing symptomology (Carter et al., 2007; Hartly & Sikora, 2009), it may be easier to overlook their endorsement of ASD behaviors. On the other hand, if girls with ASD endorse a male brain as a result of their ASD (Baron-Cohen, 1999), they would deviate from what would be typically expected in female populations. Because gender is so important in typically developing social practices, girls with ASD may be at risk for rejection and exclusion (Crick, 1997).

Whether or not children with ASD identify with their own gender is unclear. In order to contribute to the research, I will use the extreme male brain theory and social-personality perspective to guide my examination of sex differences in children and adolescents with ASD. The extreme male brain theory suggests that boys with ASD will associate with a male identity, and girls with ASD may exhibit more masculine or neutral characteristics (Baron-Cohen, 1999). The social-personality perspective suggests that gender stereotypes shape children's social preferences and behaviors. Using both theories to guide the investigation, the current study will contribute to the existing literature by examining sex differences in



school-age populations of children with high-functioning ASD and by examining the influence of gender stereotypes on ASD-symptom endorsement.

The primary purpose of this study was to examine the extent to which the social behaviors of girls and boys with ASD at school and can be characterized as masculine, feminine, or autistic. This study also sought to explore whether or not there are qualitative gender differences in the social behaviors of children with ASD.

### **Method**

This sequential mixed methods analysis (QUAL → quan → QUAL, including typology development; Teddlie & Tashakkori, 2009) is a secondary analysis of participant observation data that were collected at schools during unstructured social periods (recess, lunch, and nutrition).

### **Sample**

**ASD Sample.** Due to the small number of girls with ASD that are typically represented in research samples, data from all girls in the data set (n=38) were selected for the current study (AIR-B project, 2012). In the original study, the ratio of male participants to female participants follows epidemiological reports (4-8:1), therefore data from all males that meet the study criteria will be considered. The male sample (n=38) was randomly selected from the pool of participants to match girls by age, grade, IQ, and city of residence. Random selection of the male group controlled for the potentially confounding effects of school and site differences.

The current study is unrelated to the previous studies from which the data were drawn. The selected data were part of a larger multisite study in four different US states (California, Washington, Michigan, and Maryland). The participants in this study were in elementary school (grades 1-5), middle school (grades 6-8), and high school (grades 9-12).

To meet criteria for this study, children and adolescents with ASD had to be without intellectual disability ( $IQ \geq 70$ ; confirmed by the Stanford-Binet Fifth Edition), and educated in the general education classroom for a minimum of 80% of the school day. The diagnosis of ASD was confirmed using the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2002) and The Social Communication Questionnaire (SCQ; Rutter et al., 2008).

**Typically developing sample.** In order to establish social norms for masculine, feminine, and neutral behaviors and to triangulate the gender themes, data collected from typically developing populations in the original study were analyzed. In addition to the sample of children and adolescents with ASD, observations of 163 typically developing peers were recorded. Given that there are cultural variations across cities and school campuses, data from typically developing students who attended the same school as the students with ASD were selected.

For the current study, observation data were collected prior to the start of intervention. An explanation of the focus of the previous studies, from which these data were drawn, will help to explain how the typically developing sample was selected. The children with ASD were randomized to one of two treatment conditions. Children and adolescents with ASD who were randomized to the experimental conditions (in both the elementary and secondary schools) received social skills intervention at school during lunchtime with typically developing peer mentors. In elementary school, the peer mentors were selected because they were classmates of a student with ASD who was randomized to the peer-mediated intervention, and their teachers described them as having pro-social behaviors. In secondary schools, the peer mentors volunteered to participate in the study. They were not necessarily classmates of students with ASD, but were recommended by school personnel to

participate because of their pro-social behaviors. As such, the typically developing sample is representative of the ideal social behaviors seen in schools.

Descriptive statistics of the typically developing sample and target sample are shown in table 2. In the elementary school population, there are approximately two same gender typically developing peers for each target participant. All available typically developing peer observation data were used. Although there were less data for the secondary school population than to the primary school populations, all secondary target schools were represented by the typically developing population.

## **Measures**

**Playground observation of peer engagement.** Playground observations of children with and without autism were collected during recess on the playground and used in the original studies to examine the social behaviors of children with ASD in the natural setting at school. A live coding system was successfully applied on public school playgrounds for the past five years on various peer intervention studies. This coding system was adapted from Sigman and Ruskin (1999), Howes Peer Play Scale (1980; 1987) and Bakeman & Adamson (1984). In a previous study, the intra-class reliability correlations ranged from .70 to 1.00, and averaged .85.

This structured observation method allowed the observer to collect qualitative data for a minimum of ten minutes (and maximum of 15 minutes) per child. Qualitative descriptions of the students' social behavior during each one-minute interval were recorded. The observers were instructed to record open-ended field notes for each minute of the observation, focusing on the subject's peer group, whether or not they had a conversation, the social activity, and the child's affect. Qualitative observations of children and adolescents were recorded during recess, nutrition, and lunchtime.

Each child and adolescent in this study signed an assent form and had signed parent consent. The children and adolescents were informed that they would be observed during an unstructured social period at school during the consent and assent process. In order to mitigate possible reactivity, the students were not informed when they would be observed or who would be observing them.

### **Analysis**

Deductive techniques were used in the first strand of analysis. The qualitative field notes were converted into frequency counts to create quantitative continuous variables. Descriptive statistics (mean scores and standard deviations) of the quantitative data identified gender-related themes in social behaviors for each social category, specifically social group structure, social activities, and peer conversation. Themes identified in the first strand of analysis informed the second strand of analysis, a microanalysis of qualitative field notes to explore social characteristics by group.

To begin the first phase of analysis, themes were developed a priori to examine the social behaviors of girls and boys with and without ASD, and the extent to which the behaviors could be characterized as masculine, feminine, or neutral. Prior research identified distinct gender differences in the social behaviors of children and adolescents at schools (Maccoby 1999, 2002). Based on this literature, I developed a coding scheme to explore the social characteristics among groups. For each minute that a participant was observed, the field notes were coded for social group structure (group, dyad, alone, with an adult), social activity (socializing, game, unstructured activity, quiet activity), and conversation (with a peer, with an adult) (Figure 1).

**A priori themes.** Graduate student researchers and research assistants coded field notes. The coders were blind to the research questions, the sex, and the role (target or peer) of

the participant. Each one-minute interval of observation for each participant was coded for the presence or absence of a social characteristic. Operationalized definitions and examples of the codes are noted in Appendix 1. In order to establish inter rater reliability, the research assistants coded the same 20% of the data. Reliability was established when there was 85% agreement on each of the codes. The number of intervals in which a behavior occurred was divided by the total number of observation intervals (minutes), to determine the amount of time during the entire observation that a participant engaged in a specific behavior. Then we multiplied the product by 100 to create a percentage score.

An exploratory review of the descriptive statistics (mean scores and standard deviations) revealed gender patterns in the social behaviors of each group (girls with and without ASD; boys with and without ASD). It was determined that gendered behaviors were more apparent in elementary school populations; that children with ASD exhibit gendered behaviors; and for both boys and girls, the challenges associated with ASD preclude full social engagement.

**Typology development.** Qualitative microanalyses of the social characteristics of each group were explored in the second strand of analysis. An exploration of children's patterns of behaviors within the peer groups revealed differences in the way that boys and girls with and without ASD socialize. In typically developing populations, talking dominates the social activities of girls, whereas in male groups, talking is secondary to social activities. Within the ASD sample, girls used different social behaviors than boys. Given these distinctions, which will be discussed below, the ethnographic examples of the participant observation field notes that follow are supported by the descriptive statistics and frequency counts, and are representative of the patterns found in the data set. Finally, the interpretation of the findings

is linked back to the social personality perspective (Maccoby, 1988) and the extreme male brain theory (Baron-Cohen, 1999).

## **Results**

### **A priori themes**

The initial review of the descriptive statistics revealed gender differences and similarities in the way that the boys and girls in this sample socialized. For typically developing students and students with ASD, gender differences were more apparent in elementary school (Table 5).

**Social group structure.** On average, typically developing elementary school girls and boys were about two times more likely to hang out in a group or a dyad compared to girls and boys with ASD. Groups were the most salient social group structure. The typically developing girls and boys in our sample were twice as likely as girls and boys with ASD to hang out in a group.

**Social activity.** Gender differences were identified in the social activities of the children within peer groups. The social behaviors of children in elementary school were in line with previous research findings (Blatchford, Baines, & Pellegrini, 2003) and the social personality perspective (Maccoby, 1988, 1999, 2002). The typically developing girls in our sample spent more time socializing, while the typically developing boys primarily engaged in structured activities and games.

In addition to spending a greater proportion of recess and lunch playing structured games, elementary school boys also had a greater repertoire of games than boys with ASD and girls with and without ASD. Elementary school boys played more than twice as many games as all other groups. Interestingly, even when the elementary school boys had to play inside because of inclement weather, they still preferred games with rules to socializing and

unstructured activities. As shown in figure 1, gender themes emerged in game choice. Team sports and games with rules were much more likely to be played by boys than girls. In contrast, girls primarily played hopscotch, freeze dance, and 4-square. Tetherball and tag were played by both boys and girls and therefore are considered to be gender-neutral.

In contrast to the typically developing group, when elementary school girls and boys with ASD engaged in activities, they were likely to be unstructured. However, even within the unstructured play category, children with ASD had a limited play repertoire compared to the typically developing children. Girls with and without ASD engaged in unstructured activities more frequently than boys with and without ASD. Gender differences and similarities were detected (Figure 2). Jump-rope and swinging were more popular in female groups. Jungle gym, sandbox, and pretend play were gender-neutral activities. However, girls and boys engaged in pretend play differently. Girls with and without ASD pretended to play house, to paint each others' nails, and fix each others' hair, while the pretend play of the boys in our sample involved pretend guns and shooting.

**Conversation.** Typically developing boys and girls spent a majority of their unstructured social periods in conversation with their peers in elementary school. In fact, typically developing children were about three times as likely as children with ASD to talk to peers.

The following excerpt is representative of a typically developing male conversation. Each line represents one-minute observation intervals. In this example, the dominant activity is handball. Because of the nature of the game, the subject spends as much time on the bench waiting for his turn as he does playing in the game. This provides an excellent opportunity for conversations with peers.

1. Walking with a group of kids to handball. Happy affect
2. Moved to handball, watching play, sitting on bench.
3. Playing handball. Got out. Talked to a girl on the bench. Another boy came over and they had a conversation. Happy affect.
4. In game. Get interesting responses to friendly chuckles from boys on the bench laughing.
5. Laughing. Playing handball. Friendly competition – everyone is laughing.
6. Conversation on the bench. Watching play and laughing.

The following example is representative of typically developing female conversations, with each line representing one-minute observation intervals. Typically developing girls spend a larger proportion of their unstructured time in conversation and socializing. In the beginning of the observation, a typically developing girl is sitting and talking to her peers while eating her snack. In the third minute she stands to change her activity, maintaining her conversation and responding to a girl. She widens her attention to continue a conversation with two girls in the fourth minute. Then, she shifts her attention back to the table, sits down and joins in another conversation. She moves to yet another conversation again in minute ten. In the eleventh minute, the entire group continues their conversation while they move to the play area. By the end of her observation, she continues talking to her friends while she begins to jump-rope.

1. Conversation while eating. Positive affect
2. Sitting with others, smiling and talking
3. Stands to respond to another girl's conversation
4. Conversation with two other girls. A lot of positive affect. Gesture use
5. Continues conversation. Responds to a different girl
6. Deep in conversation with other girls at table



7. Initiates to a different peer. Still talking.
8. Positive affect. Deep in conversation
9. Talking and smiling. Very animated, lots of gesture use
10. Third girl wants to get her attention. Then brings her into the conversation
11. Walking and talking
12. Decides to play jump-rope with another classmate
13. Walking with a friend. She is jump-roping and friend is playing ball
14. Conversation with her friend while jump-roping

Beyond girl talk, the previous excerpt highlights the fluidity with which girls socialize (Goodwin, 2006). While the typically developing girl in this excerpt spent the entire observation interval in a group, there was flexibility in the group dynamics. She shifted in and out of conversations with multiple peers, changing positions and activities, yet remained fully engaged and actively involved in conversations.

### **Typology development**

The descriptive statistics demonstrated similarities in the peer conversation profile of the boys and girls with and without ASD in the sample. Upon closer inspection of the observers' notes, however, gender differences were revealed. Within the group structure, 75% of the typically developing girls primarily engaged in talking activities (walking and talking, sitting and talking). Even when girls played games and participated in activities, talking tended to be their primary focus. While typically developing boys also engaged in talking activities (44%), their primary focus was playing games (63%).

**Social multi-tasking.** An important theme revealed in the data is that boys and girls multi-task while hanging out with their friends. Social characteristics did not occur in isolation. Gender differences were identified in the ways in which boys and girls socially

multi-task. Typically developing boys had conversations while playing games, whereas typically developing girls participated in activities while talking. As will be discussed later, the act of social multi-tasking presented challenges to boys and girls with ASD.

The following example is an 11-minute observation of a typically developing boy during recess. This example highlights how boys socialize and engage in conversation around a structured play activity. In the beginning of the observation, the boy is actively involved in a kickball game with multiple peers. When the ball is kicked out of bounds, he has a conversation with fellow players. When the ball returns in the third minute, the kickball game, not the conversation, regains his attention. Again, in the next minute boy engages in a conversation while he waits for the out-of-bound ball to return for play. When the ball is returned, the boy remains in active play for the rest of the observation interval. Throughout the observation, the typically developing boy is simultaneously attending to the play status of the game while engaging in conversation.

1. Playing kickball with multiple peers
2. Ball kicked out; conversation with peers
3. Playing kickball with multiple peers
4. Continues to play kickball with peers; positive affect
5. Conversation with peers while waiting for ball to come back
6. Continues to play kickball game with multiple peers
7. Continues to play kickball game with multiple peers
8. Continues to play kickball game with multiple peers
9. Continues to play kickball game with multiple peers
10. Continues to play kickball game with multiple peers
11. Continues to play kickball game with multiple peers

For the typically developing boy in the previous example, participation in the kickball game facilitated peer conversations. Conversely, as illustrated by the next 12-minute example, conversation facilitates the activity in the typically developing female groups. Moreover, this next example highlights that female social groups are characterized by fluid movement from peer to peer and from activity to activity. The example illustrates female social multi-tasking. At the beginning of the observation interval, the girls begin to walk and talk around the yard until they settle in one area and begin to pretend to paint each other's nails. Then the social activity quickly morphs into a game of hide-and-seek. By the end of the observation, the girls resume walking and talking.

To effectively participate in a social group, the girl in this example had to pay attention to the various cues while complying with implicit social rules and reciprocal play. Moreover, the girl fluidly moved from one activity to the next while continuing to attend to her peers by maintaining a conversation and a cohesive group structure.

1. Walking around with 2 other girls, smiling, happy.
2. Walking with 2 other girls, talking and smiling. Happy.
3. Walking around, arm in arm. Smiling, Laughing.
4. Sitting in a circle. Talking and pretending to paint each other's nails.
5. Still pretending to paint each other's nails. Humming, happy.
6. The three girls get up. She grabs one by the hand and they all run off. She is happy.
7. She wants to play hide-n-seek and one girl agrees.
8. They start playing hide-n-seek. She counts and looks for her friends.
9. Finds friends, now she goes to hide.
10. She gets found, laughing and screaming.
11. Bell rings, she lines up talking to one other girl.
12. Still talking with girl. She is happy.

### **Gender differences in the social behaviors and challenges of children with ASD.**

The current findings build on our understanding of male and female play preferences in ASD samples. Unlike prior studies, which measured gender preferences in clinics or with survey measures, the current study measured social characteristics and behaviors in the natural setting. The analysis indicates that context is relevant and that the influence of gender in the social environment at school affects the play and social behaviors of children with ASD. Gender differences and similarities were identified in the way that elementary school boys and girls with ASD socialized.

Similar to typically developing girls, hanging out in a group was the most salient social group structure for girls with ASD. Compared to typically developing boys and girls with and without ASD, boys with ASD spent more time alone. In addition, examinations of social activities revealed that girls with ASD in our sample tended to play feminine and gender-neutral activities, and boys with ASD leaned toward masculine play. While all children with ASD experienced challenges during social periods, girls employed different strategies to try to stay engaged. In contrast, boys employed strategies to avoid playing with others.

Yet despite appearing to be engaged in social play, girls with ASD were not fully included in the group and struggled to keep up socially. A closer examination of the qualitative field notes showed that even though girls with ASD actively participated in activities, they had difficulty socially multi-tasking. Consequently, their participation was less than would be expected of a typically developing girl. For example, as the typically developing girls flit around from person to person or activity to activity, they continue to socialize and carry on conversations with their peer group throughout the entire observation

period. Girls with ASD, on the other hand, seem unable to socialize while engaging in activities, and wandered in and out of social environments without maintaining conversations or social connections. Consequently, girls with ASD had difficulty synchronizing with group social norms.

The following 12 - minute excerpt is representative of an elementary girl with ASD playing with a group of friends. Feminine behaviors were present; walking and talking was the dominant activity in this observation. However, the girl with ASD was unable to stay actively involved in the social group throughout the duration of the observation.

1. Playing a game of caterpillar (a picture of a caterpillar is painted on the ground and girls are jumping from one circle to another). She is jumping with 3 girls.
2. Caterpillar activity 4 girls total. She is jumping in the letters (painted in each circle). Neutral affect.
3. Walked away from the girls, near a crowd of boys who are standing around. No talking neutral affect.
4. Walking near a group but not part of the group. There are three girls with each other and target is standing nearby, but by herself.
5. Standing near 2 girls looking around. She is not part of a group but close. Neutral affect.
6. Three starts to try to initiate to the girls to do something else. They have conversation.
7. Walking on the yard with girls. She has one conversation. The girls try to walk away and she goes to them.
8. Walking with three girls. There is no talking. She is toe walking.
9. Four girls are jumping in painted circles on the playground. She is happy.
10. She is happy leaping from circle to circle. Laughing
11. Wanders from girls and has a conversation with a group of boys. There are 4 exchanges in the last 15 seconds.

12. Running by herself and then walked to the group. Then she walked away. Neutral affect.

In the beginning of the observation period, the girl with ASD is participating in an unstructured activity with a group of girls, but she is not interacting or engaging in social conversation *while* she participates in the activity. In the third minute, she walks away from her peer group and spends the following three minutes near, but not part of the group. In line 6, she comes back to her peer group, and after three attempts, successfully initiates a conversation with the typically developing girls, highlighting her willingness and ability to make social initiations. In the seventh minute, she conforms to feminine group social norms by continuing to walk and talk with the girls, but the girls in her group walk away from her. Not responding to their alienating social cue, she follows them in the eighth minute, and continues to walk with the group. This time, she does not talk. In the ninth minute, the girls resume playing the caterpillar game. After two minutes, she leaves the group of girls and wanders to a group of boys and has one short conversation. She leaves the boys at the end of the observation, and tries to rejoin her former group. Ultimately, she is left alone.

Despite using social initiation skills, she was most successful in the female peer group when she was not talking. In fact, when she started a conversation, the group rejected her. Although the girl with ASD did have a conversation with the boys, it was short and she ultimately left them to seek acceptance back into the female group.

Boys with ASD, like typically developing boys, also endorsed masculine behaviors. But the challenges associated with ASD made full social engagement difficult. Unlike all other groups, the boys with ASD in our sample spent a majority of their time alone. Boys with ASD were nearly two times as likely as girls with ASD to be alone during unstructured

social periods at school. In contrast to girls with ASD, the social challenges of boys with ASD were much easier to detect.

The following 12-minute excerpt is representative of a dominant theme in play routines of boys with ASD. In this example, the boy with ASD is playing with a basketball, which is associated with male play, but he is playing by himself. In addition, as would be expected in typically developing populations, the boy with ASD engages in one activity for the majority of the observation period. He has several opportunities to play with a peer, but is unable to develop peer interactions into full joint engagement. In the first seven minutes of the observation, the boy with ASD is playing basketball by himself. In the eighth minute, another boy begins to dribble next to him. Yet the target maintains his own isolation by failing to synchronize his play with the boy next to him. Instead, he switches his activity to kicking the ball, marking his disinterest in playing with a peer. Then in the tenth minute, he picks up the basketball and walks alone, sending another social signal that he would like to play alone. A girl joins him in the twelfth minute, and they begin to toss the basketball back and forth. She then takes the ball and walks away, without including him in her next social activity. Nevertheless, he follows her.

1. Playing with basketball alone on tennis court
2. Playing with basketball alone on tennis court
3. Playing with basketball alone on tennis court
4. Playing with basketball alone on tennis court
5. Playing with basketball alone on tennis court
6. Playing with basketball alone on tennis court
7. Playing with basketball alone on tennis court
8. Another boy played basketball next to him bouncing the ball.
9. Kicking the ball

10. Walking with basketball
11. Walking alone
12. 1 girl. Tossing basketball with one girl for a few seconds. Follows girl who took basketball.

**Gender differences within the ASD sample.** Several social characteristics were more prevalent in girls with ASD than in boys with ASD. Girls with ASD used social initiations to gain access into groups and they were more persistent in taking action to rejoin a group when they were left out. But social communication deficits associated with ASD made it difficult for girls with ASD to socially multi-task. Consequently, while girls with ASD appeared to be engaged in groups, their struggles having conversations while participating in social activities limited their full acceptance as a group member.

The next 12-minute example involves a girl with ASD jointly engaged in play, but not as a full and equal participant. The girl with ASD is engaged in a jump-roping activity, which is associated with feminine play. On the surface, it appears that she is fully engaged in the group activity and conforming to social norms. But she is hanging out with a younger peer group than would be expected of typically developing populations. She also deviates from what would be socially expected from girls because she does not socially interact with her peers. Instead, her primary focus is swinging the jump-rope, whereas in the typically developing female group jump-roping would be secondary to socializing.

At the beginning of the observation session, the girl with ASD is standing near, but not part of the social group. In the second minute, she greets a group of girls that are younger than her. She begins playing with younger kids by swinging the jump rope (minute three). In minutes five and six, she continues to swing the jump rope, but is not



talking or interacting. She has a short conversation with her playmates about the game (minute eight), and then continues to swing the rope. In the twelfth minute, the observer's notes reveal that the girl with ASD never takes, and never is given, a turn to jump rope. Therefore, her participation in the activity is contingent on her swinging the rope for other children, making her unequal in status to the rest of the group.

1. Watching four girls (same age). Holding jump rope, standing near other girls who are jump-roping and watching them.
2. Goes up to younger girls who are jump roping and says hi briefly. Girls walk and then she observes as other girls play
3. One younger girls and 2 boys. Gives rope to younger girl and asks her to play. Play jump rope with her and two boys.
4. Playing jump-rope with two boys and one girl- younger.
5. Playing jump-rope with younger kids, swinging the rope but not talking or interacting
6. Playing jump-rope with younger kids, swinging the rope but not talking or interacting
7. Swinging the jump-rope as the other girls are jumping, not talking to them.
8. Talking briefly with girls about the game. Then the other girl leaves and she observes others playing jump-rope.
9. Observes others play for most of this interval, then starts swinging the jump-rope with another girl
10. Swinging jump-rope for the girls.
11. Just standing there watching others most of this interval, then starts swinging rope again
12. Swinging the rope with another girl again- she is always swinging the rope but never in middle jumping

The following representative 12-minute excerpt reflects the tendency of boys with ASD to send signals that they want to be alone, the role that adults have in the social engagement of boys with ASD, and the tendency of boys with ASD, to reject social initiations from others. In this excerpt, the target spends a majority of the observation period coping with his social challenges by engaging with an adult. In the beginning of the observation session he is alone (minute one). He talks with the adult in the second minute, but when a classmate also joins the conversation, the boy with ASD ignores her. In the third minute of observation, the target sits with two paraprofessionals and no other children. When he finishes eating, he walks to the yard and is followed by his aide who is engaging in his preferred activity. He rejects an invitation to play from his classmate, sending a signal that he is not interested in social engagement. Yet when the rejected peer walks away, the target follows him to the handball area, highlighting the contradiction between his words and his actions. Seeing his difficulties, the paraprofessional tries to facilitate social engagement. However, the target does not acknowledge the child and only speaks to the adult, thus marking his second signal of disinterest in playing with the boy. In the twelfth minute the target agrees to play basketball with the other child, but instead of beginning the game, the boy with ASD wanders away.

1. Sitting alone eating snack. Smiling.
2. Aide comes up and sits at table with him. Smiling and talking to his aide. A girl comes up to talk to aide too. He doesn't pay attention. Neutral affect
3. Still at the table with just two aides, and no other kids around. Eating snack and talking to his aide.
4. Smiling and staring at juice box. Starts to go to yard.

5. Wandering around with head down. Alone looking at his head down. Alone. Looking at his own shadow.
6. Aide explains that he can't look at his shadow while he's walking, but only when he stops so he doesn't run into anyone.
7. Still wandering around alone. Neutral.
8. Another kid asks him to play with him but he says "no."
9. Kid goes and gets ball and target follows him. Walking near boy to handball.
10. Target wanders off from other kid. Walking alone. Neutral
11. Aide really trying to facilitate play with other kid. He only talks to her though. Neutral.
12. Kid asks him to play basketball and he says yes, but then he wanders off. Neutral.

### **Gender differences in the social behaviors of school-age adolescents are minimal**

**Typically developing adolescents.** In secondary school, socializing was the dominant social activity for both typically developing boys and girls. In fact, unlike the children in the elementary school sample, no typically developing adolescent boy or girl in the sample engaged in games. The data indicated that gender differences neutralized in secondary school. The social activities of adolescent girls were consistent with elementary school girls. The social activity of adolescent boys, however, seemed more in line with elementary school girls than elementary school boys. Both male and female adolescent groups socialized in flexible groups, where talking was the primary activity.

The following 10-minute excerpt is representative of the shift in the social behavior of typically developing adolescent males. In the adolescent population, each line represents two-minutes of observation. At the beginning of the observation, the subject leaves his classroom, runs into a friend, and walks with him to the cafeteria. They have a conversation while they are waiting in line. The conversation continues as they take their food to go meet up with another group of boys, which highlights the flexible social grouping. It is apparent

that conversation is the dominant social focus when the subject realizes that he has not eaten his food because he was so involved in socializing and talking. He begins to socially multi-task, continuing to synchronize with the group conversation, listening while eating, and remaining fully engaged as a group participant.

1. Leaves class. Goes down to food court. Runs into another kid. They talk and wait in line together.
2. They get food and walk over to group of boys. They all talk.
- 3.. Group of boys still talking. Happy. Smiling. Laughing.
- 4.. Still talking with other boys. Realizes he's barely eaten any food. He takes a few bites and listens.
5. Eating food and listening to other boys and talking.

As represented in the previous example, the tendency to hang out with same-sex peers persisted into secondary school. However, co-ed social groups were more common in secondary school than in elementary school. Social group structures became more flexible as groups of boys and girls blended together. The next 10-minute example is representative of mixed gender groups and socializing. In the first two minutes, the female peer begins socializing with her same gender peer group. By line three, the group dynamics shift when a group of boys join her group. The social flexibility is evident as the typically developing girl continuously adjusts to her expanding social group.

1. With her friends talking and hugging standing in a circle
2. Still standing with her friends talking and laughing
3. Girls and guys in the group talking.
4. Laughing and hanging out in the crew of friends
5. Enjoying her lunch talking and laughing

**Adolescents with ASD.** Like typically developing populations, there were fewer gender differences between girls and boys with ASD in secondary school compared to elementary school. Most notably, adolescent boys with ASD spent more time in conversation, socializing, and hanging out in groups than elementary school boys. The characteristics of adolescent girls with ASD were similar to elementary school girls with ASD, except that the adolescent girls spent a greater proportion of time alone.

The following 10-minute example is of a girl in secondary school who is trying to conform to social norms by socializing with a peer group while eating lunch. Her difficulties are two-fold. First, peers move away from her when she sits down at the lunch table on two occasions within one observation interval. Second, when she is in a group, she never fully synchronizes with the group social norm. Instead of hanging out and socializing when she is finished eating, she leaves, not staying in the group long enough to socially engage.

In line one, the girl with ASD goes to sit at a lunch table and socialize on two occasions, but both times, the group moves away from her. In line two, the girl with ASD sits by herself at the table and looks around at other groups. In the third minute, she is successful in joining a group of girls, but leaves the group in the fourth minute. She then goes to the library and has one short conversation. By the end of the observation interval, she is reading books in the library alone.

1. Went to sit at a table of girls, but they moved. Went and sat next to another girl, but she moved then too. Seems to be watching other kids walk by.
2. Eating and looking around at groups of kids kind of standing around. Aid tries to talk to her. She seems to want to engage, but doesn't know how.
3. Sitting w/ group of girls. Talks to them.

4. Sitting, finishes up. Goes into library, Talked to one girl.
5. Sitting on floor in library. Looking at books and reading alone on floor.

Like the girls in the elementary school population, the adolescent girl in this example made several attempts at social initiation, and was persistent in joining a group. Yet she was unable to position herself as an active member of the group or to fully participate. Like most of the adolescent girls and boys with ASD in the sample, she ultimately leaves the social environment to isolate in a quiet setting, the library. This is consistent with the descriptive statistics indicating that the adolescent girls with ASD spend more time alone in secondary school than in elementary school.

There was an increase in conversation in the adolescent population of boys with ASD compared to the younger sample. Being alone was the dominant social activity in adolescent boys with ASD. Similar to girls with ASD, however, adolescent boys with ASD had closer proximity to peers than the elementary school boys with ASD. The following 10-minute example is representative of an adolescent boy with ASD spending time in a peer group. In the beginning of the observation, he sits at a table of peers to eat lunch and engage with a group of boys. He is at the periphery of the group, but attends to the conversation. Synchronizing with the group, he gets up when everyone finishes eating. By the end of the observation, an adult helps him to enter another social group and he engages in a conversation with the other boys.

1. Got lunch in cafeteria. Walked up to a group of boys and sat down. Joined a large party conversation. At the periphery of talk, more listening, but in conversation
2. In multi-party conversation. No eye contact, but follows conversation. Teacher comes to table to talk. Then kid conversation continues.
3. Kids finish and get up. Leave cafeteria. He goes to B-room by himself.

4. Walks across yard by himself Walks up to a group of boys at the field, at periphery. Walks to another group with an adult. Adult facilitates beginning of conversation. Conversation with the boys.

## **Discussion**

The purpose of this study was to examine how children and adolescents with ASD navigate social settings at school and the extent to which they used gendered behaviors when socializing. This is the first study to use observational data collected in the natural environment to examine the social behaviors of children with ASD at school. The results indicate that environmental contexts shape the endorsement of gendered behaviors in ASD populations. The findings indicate that there were gender differences in the way that girls and boys with ASD socialize, and in the presentation of ASD symptom endorsement.

Previously reported studies of school-age populations indicated that social competence and school acceptance are largely contingent on same-sex friendships and adherence to gender norms (Hall, 2010; Macoby, 1988; Rose & Asher, 1999). For children who have difficulties fitting in, navigating different group dynamics may exacerbate symptoms of social incompetence. The current findings indicate that girls and boys with ASD have difficulty fitting in for different reasons.

Examinations of the social behaviors in typically developing populations indicated that gender characteristics were more prominent in elementary school populations, and appear to diminish in secondary school. In elementary school, both typically developing boys and girls have conversations throughout recess and lunch. For boys, conversations are a secondary focus to games and organized play. In contrast, the typically developing girls in the sample formed activities around conversation and socializing. In secondary school,

neither boys nor girls played games, instead conversation and socialization were the social focus.

The data suggest that basing our understanding of gender differences in ASD samples solely on the dimorphic male or female brain, as described by the extreme male brain theory, limits our understanding of the social preferences and behaviors of people with ASD. The children with ASD identified with their own sex and responded to gender cues within their social context. Moreover, the boys and girls with ASD shared social characteristics with their same gender peers, particularly in terms of preferred social activities.

Gender differences were detected within the ASD population both in the use of normative gender behaviors and in the social behaviors that were related to the deficits associated with ASD. Boys and girls with ASD responded to gender contexts when participating in social activities at school. Girls with ASD engaged in feminine social activities such as unstructured play and joining groups where hanging out and talking were the primary activity, and boys with ASD were attracted to masculine play objects like basketball, and male forms of pretend play (e.g., secret agents).

In line with previous clinical descriptions (Atwood, 2007; Kopp & Gilberg, 1992), the girls with ASD in this sample were better able to mask their social challenges than boys with ASD. Being able to position themselves within a group, even engaging in an activity, made girls with ASD appear jointly engaged with their peer group. Moreover, girls made more social initiations and were more persistent in their attempts to position themselves within a group. Thus, as previously reported in prior research, girls with ASD appeared more socially interested than boys (Atwood, 2007; Kopp and Gilberg, 1992). But a deeper examination of the social experiences of girls revealed an unbalanced social dynamic, with girls with ASD never being fully or equally included in their peer group, or being rejected.



So, although girls with ASD were able to make social initiations, persist in their attempts to be included, and engage in at least one facet of a social activity, the girls experienced more rejection than boys with ASD.

In contrast to girls with ASD, boys with ASD primarily spent their social periods alone, making their social challenges much easier to detect. Compared to typically developing boys, boys with ASD were attracted to masculine play activities (e.g., sport-balls and male pretend play), but had a much smaller play repertoire than the typically developing populations and girls with ASD. The social characteristics of boys with ASD appeared different than girls with ASD in two ways. First, boys with ASD appeared less interested in group-activities altogether, which ultimately seemed to promote their own isolation. Second, even when the boys with ASD were in close proximity to a peer, or invited to play, they missed opportunities, and rejected offers. Therefore, unlike girls with ASD who were rejected by their peers, boys with ASD in this sample initiated the rejection of their classmates by declining play invitations and ignoring their peers.

These findings have several implications. Unlike boys with ASD, who tended to be alone or with an adult, the social participation of girls with ASD looked more competent than it actually was. Thus, scanning the playgroup from a distance was not sufficient to detect the social challenges of girls with ASD, whose experiences were more nuanced and less obvious. Despite appearing fully integrated in their group, the social communication deficits associated with ASD lead to undervaluation as a group participant, alienation, and rejection. Girls with ASD would benefit from social interventions specifically designed to strengthen their ability to socially multi-task by developing flexible play while attending to multiple social cues and by maintaining social conversations throughout ever changing play activity and group changes.

The social challenges of boys with ASD were easier to detect. A deeper examination of the social behaviors of boys with ASD in this sample also revealed characteristics that were unique to the boys with ASD. First, boys with ASD had a pattern of not accepting implicit or blatant social invitations to play. Second, when they did engage in social activities, their play repertoire was much more limited compared to their typically developing classmates. Third, boys were more dependent on adults for socialization, and seemed to avoid conversations with classmates and age-appropriate peers. Consequently, the social isolation of boys with ASD appeared to be attributable to their failure to accept social initiations and opportunities, having more restricted play skills, and a tendency to misappropriate their social attention. To be perceived as socially competent in male groups, boys must know how to multi-task while participating in structured activities and attending to group dynamics. Therefore, boys with ASD would benefit from building a larger play repertoire and following through with joint engagement.

In both typically developing and ASD populations, gender differences diminished in secondary school. Hanging out and talking was the most dominant activity in the typically developing group. In contrast, the most salient activity in the ASD sample was being alone. Even though male and female adolescents with ASD spent a portion of their nutrition-time and lunchtime in a peer group, they had difficulty jointly participating in conversation, and had a tendency to leave social groups and isolate. The current findings suggest that adolescents with ASD lack skills to meet the social demands of secondary school socializing.

There are several limitations to this study. First, the adolescent sample is much smaller than the elementary school sample, thus limiting the ability to generalize the findings to wider populations of secondary school students with ASD. Second, this is a cross sectional study. Future research examining the social development of typically developing children

and children with ASD may be able to better characterize the causal relationship between social skill strengths and deficits in elementary school and social behaviors in secondary school using a longitudinal design. Finally, the current study is a secondary data analysis of participant field notes collected for different research goals, which precluded an iterative data collection process.

## **Conclusion**

The findings presented in this dissertation highlight subtle differences between boys and girls with ASD at school. Gender differences in internalizing behaviors and social characteristics revealed that challenges associated with ASD are less obvious in girls than in boys. Consequently, clinicians and school personnel may need to shift their expectations of how the symptoms of ASD manifest themselves in school. They also may need to become more sensitive to the contextual factors that obfuscate the unique social challenges of girls.

The social communication challenges of girls with ASD in a natural setting were less obvious than the challenges of boys. Girls with ASD had difficulty simultaneously engaging in conversation with their social group while participating in social activities. Considering this social limitation and their ‘at risk’ rates of internalizing symptomology, girls with ASD appeared unable to access positive coping strategies that have been associated with being female (Rose & Rudolph, 2006). Having difficulties with socializing can preclude girls with ASD from being able to talk about their feelings and making meaningful female relationships.

Our current understanding of the social deficits associated with ASD at schools may not accurately reflect girls’ experiences. In the current study, the social challenges of boys with ASD were more obvious. In line with prior research, boys were isolated or on the periphery of social groups. In contrast, girls with ASD looked like they were participants in a group. More nuanced contextual examinations, however, revealed that their participation as a group member was superficial. Therefore, the findings from this study suggest possible biases in our current understanding of the way that girls endorse the social deficits associated with ASD. Because of this, school personnel may overlook the needs of girls.

Both parents and teachers reported that externalizing behaviors of boys and girls with ASD were similar to each other, and to what would be expected in typically developing populations. The literature examining teachers' perceptions of students with ASD, however, primarily focuses on the association between negative attitudes and externalizing behaviors (Machalick et al., 2007). In addition, children with greater externalizing behaviors are more likely to receive interventions and additional supports in school (Dhuey & Lipscomb, 2010). Given that the externalizing behaviors of children with ASD in this sample fell within the average range, more research is needed to examine possible biases in parent and teacher perceptions of externalizing behaviors. Future studies are needed to determine if the diagnosis of ASD causes parents and teachers to perceive the behaviors of boys and girls with ASD as more severe than the similar behaviors of typically developing boys and girls.

With regard to ASD, context is relevant. There were similarities between the boys and girls with ASD in this sample and their typically developing peers. However, difficulties associated with ASD were apparent. In order to be socially successful within their same-gender group, the girls and boys with ASD needed a different repertoire of social strategies. These findings do not endorse or reject gender related interventions. Instead, the findings call attention to gender as a salient contextual factor at schools. Thus, in addition to considering the deficits associated with ASD, the influence of gender on socializing should be considered when designing interventions for children with ASD at schools.

## Tables

Table 1. Descriptive statistics and non-significant site differences on the primary outcome variables

DV	Site Mean (sd)				ANOVA	
	Los Angeles	Baltimore	Anne Arbor	Seattle	F(df)	p-value
Social communication	12.70 (4.91)	15.60 (5.21)	12.33 (4.56)	14.82 (4.45)	1.58 (3,68)	0.2
RIRB*	2.17 (1.64)	2.50 (2.07)	3.05 (1.99)	2.36 (1.91)	.96 (3,68)	0.42
SCQ*	10.12 (10.17)	14.70 (7.99)	13.00 (8.49)	8.67 (10.61)	1.04 (3,63)	0.38
NVFR*	10.03 (3.02)	11.22 (3.80)	9.32 (2.69)	8.45 (2.21)	1.76 (3,71)	0.16
VKN*	6.97 (2.61)	9.89 (4.46)	9.04 (4.06)	8.09 (3.02)	2.50 (3,71)	0.07
Parent Internalizing	55.96 (12.99)	51.75 (8.82)	57.78 (13.80)	53.00 (9.23)	.62 (3,60)	0.61
Teacher Internalizing	55.50 (10.64)	54.22 (8.47)	60.38 (15.91)	61.88 (11.93)	1.06 (3,60)	0.37
Parent Externalizing	55.96 (8.42)	55.75 (5.23)	53.00 (7.60)	59.67 (9.26)	1.61 (3,61)	0.2
Teacher Externalizing	53.54 (9.41)	53.67 (11.35)	53.06 (9.76)	61.13 (16.07)	1.16 (3,60)	0.34

\*RIRB = Repetitive behaviors and restricted interests; SCQ = Social communication questionnaire; NVFR = Nonverbal fluid reasoning, VKN = Verbal knowledge

Table 2. ANOVA tests of gender differences in ASD symptom endorsement

	Total Mean (sd)	Female Mean (sd)	Male Mean (sd)	Gender		Age		Gender x Age	
				F (df)	Sig.*** (2-tailed)	F (df)	Sig.*** (2-tailed)	F (df)	Sig.*** (2-tailed)
Social Com.*	13.32 (4.90)	12.97 (4.82)	13.67 (4.90)	.224 (1,68)	0.64	1.43 (1,68)	0.24	.07 (1,68)	0.78
Stereotype*	2.50 (1.85)	2.33 (1.74)	2.67 (1.96)	.064 (1,68)	0.8	.67 (1,68)	0.42	.00 (1,68)	0.99
SCQ	11.60 (9.39)	11.19 (9.13)	12.10 (9.83)	.62 (3,63)	0.43	2.67 (1,63)	0.11	1.01 (1,63)	0.32
NVFR**	9.71 (2.96)	10.03 (2.95)	9.38 (2.98)	4.56 (1,71)	0.04	1.80 (1,71)	0.18	3.65 (1,71)	0.06
VKN**	8.17 (3.55)	8.37 (3.80)	7.97 (3.03)	2.46 (1,71)	0.122	1.08 (1,71)	0.3	3.36 (1,71)	0.07

\* Social com. = ADOS Mod 3/4 Social communication scores; Stereotype = ADOS Mod 3/4 stereotype behavior scores

\*\* ABIQ = SB-5 Abbreviated intelligence score; NVFR = SB-5 Non-verbal fluid reasoning score; VKN= SB-5 Verbal knowledge score

\*\*\* P-value from ANVOA

Table 2. Descriptive statistics of the city of residence, age, grade and school level of the target and peer sample.

				Target			Peer		
				n	Range	Mean (sd)	n	Range	Mean (sd)
Primary	Female	Anne Arbor	Age	5	6-8	6.83 (0.53)	11	6-11	7.82 (1.40)
			Grade		1-3	1.83 (0.75)		1-5	2.73 (1.19)
		Baltimore	Age	5	7-9	8.20 (0.84)	23	6-11	7.87 (1.42)
			Grade		2-4	3.20 (.84)		1-5	2.83 (1.34)
		Los Angeles	Age	10	6-11	7.60 (1.35)	14	6-19	7.64 (1.22)
			Grade		1-5	2.50 (1.18)		1-5	2.71 (1.20)
	Seattle	Age	4	7-10	8.40 (1.40)	20	7-11	8.80 (1.16)	
		Grade		2-5	3.40 (1.14)		2-5	3.70 (0.92)	
	Male	Anne Arbor	Age	5	6-10	7.60 (1.82)	9	6-11	8.44 (1.59)
			Grade		1-5	2.60 (1.82)		1-5	3.33 (1.41)
		Baltimore	Age	5	7-9	7.80 (0.84)	33	6-11	8.76 (1.44)
			Grade		2-4	2.80 (0.84)		1-5	3.64 (1.27)
		Los Angeles	Age	10	6-10	7.50 (1.08)	21	6-10	7.33 (1.46)
			Grade		1-5	2.50 (1.08)		1-5	2.38 (1.43)
Seattle		Age	4	7-11	8.75 (1.71)	8	7-10	8.50 (1.07)	
		Grade		2-5	3.50 (1.29)		2-5	3.50 (1.07)	
Secodary	Female	Los Angeles	Age	5	13-19	15.60 (2.41)	10	12-18	15.90 (2.13)
			Grade		8-12	9.80 (1.64)		7-12	10.80 (2.04)
		Seattle	Age	6	13-18	14.83 (2.23)	5	13-17	15.20 (2.05)
			Grade		8-12	5.50 (4.37)		8-11	9.80 (1.64)
	Male	Los Angeles	Age	5	13-18	15.20 (1.92)	7	13-17	15.71 (1.89)
			Grade		8-12	9.40 (1.67)		8-12	10.71 (1.89)
		Seattle	Age	10	11-18	13.50 (2.27)	2	12-13	9.50 (3.54)
			Grade		6-11	7.40 (2.01)		7-1	10.00 (4.24)



Table 3. Parent and teacher reports of internalizing and externalizing behaviors: mean scores (standard deviations).

Sex	School category	Parent		Teacher	
		Internalizing	Externalizing	Internalizing	Externalizing
Female	Primary	58.08 (10.41)	53.96 (7.35)	58.61 (13.62)	53.87 (12.32)
	Secondary	61.55 (12.80)	56.36 (7.43)	66.00 (9.52)	53.67 (8.35)
	Total	59.71 (11.14)	54.71 (7.36)	60.14 (13.09)	53.83 (11.47)
Male	Primary	47.95 (11.84)	57.15 (9.54)	53.60 (9.97)	56.15 (11.52)
	Secondary	58.00 (11.67)	54.30 (7.39)	58.13 (13.39)	52.75 (7.69)
	Total	51.41 (12.55)	56.20 (8.86)	54.89 (10.99)	55.18 (10.55)
Total	Primary	53.60 (12.06)	55.41 (8.47)	56.28 (12.19)	54.93 (11.87)
	Secondary	59.86 (12.10)	55.38 (7.30)	61.50 (12.16)	53.14 (7.67)
	Total	55.66 (12.34)	55.40 (8.06)	57.56 (12.28)	54.49 (10.95)

Table 4. Descriptive statistics: Mean scores and standard deviations of social group structure, social activity, and conversation scores

	Primary				Secondary			
	Female		Male		Female		Male	
	Target (24)	Peer (61)	Target (24)	Peer (57)	Target (9)	Peer (15)	Target (9)	Peer (9)
<b>Social group structure</b>								
Group	26.88 (30.38)	51.48 (33.03)	21.17 (25.64)	54.04 (35.38)	16.50 (14.96)	75.33 (30.91)	27.60 (27.06)	59.44 (31.27)
Dyad	13.40 (18.08)	31.83 (26.60)	19.61 (53.27)	25.39 (28.38)	15.13 (17.61)	16.00 (18.44)	14.40 (21.05)	22.78 (18.56)
Alone	18.48 (24.21)	4.43 (10.47)	32.5 (32.44)	4.60 (9.31)	28.38 (24.62)	7.33 (16.24)	43.00 (35.43)	11.11 (20.28)
Near Group	10.44 (18.07)	2.54 (6.59)	8.22 (14.02)	2.89 (7.49)	18.75 (15.53)	24.00 (41.71)	20.93 (24.59)	20.00 (36.06)
<b>Social activity</b>								
Socializing	13.32 (18.70)	48.66 (28.20)	17.74 (22.94)	38.95 (23.75)	17.75 (18.22)	60.00 (50.71)	26.93 (35.99)	60.00 (44.72)
Game	8.28 (20.17)	25.50 (32.93)	6.52 (13.17)	43.00 (34.81)	3.75 (10.61)	*	8.00 (25.97)	*
Unstructured	28.20 (29.92)	29.45 (31.31)	27.87 (30.40)	23.70 (26.95)	43.13 (28.22)	*	24.00 (27.72)	4.44 (8.82)
Quiet Activity	6.29 (18.88)	7.33 (19.30)	3.261 (10.33)	7.49 (19.55)	6.00 (10.32)	12.67 (31.73)	20.20 (33.41)	11.11 (22.61)
<b>Conversation</b>								
Peer	21.24 (24.85)	91.51 (16.51)	23.78 (29.14)	91.51 (18.68)	25.25 (23.13)	87.33 (31.73)	35.80 (31.62)	80.00 (26.55)
Adult	10.84 (23.15)	1.63 (4.13)	4.13 (9.13)	1.68 (3.62)	6.50 (9.30)	*	6.2 (13.40)	4.44 (13.33)

\* No one in the sample participated in the activity or conversation.

## Figures

Figure 1. Example of deductive coding techniques: Converting qualitative field notes to quantitative data

Field notes	Conversation		Social Organization			Activity			
	Peer	Adult	Group	Dyad	Alone	socialize	game	unstructured	quiet activity
With three friends engaged in conversation. Surrounded by others. Smiling	x		x			x			
Playing kickball with a group of peers			x				x		
Wandering around. Playing pretend play alone.					x			x	
Playing with friend on structure; eye contact Walking and talking	x			x				x	

Figure 2. The games that elementary school children played at school

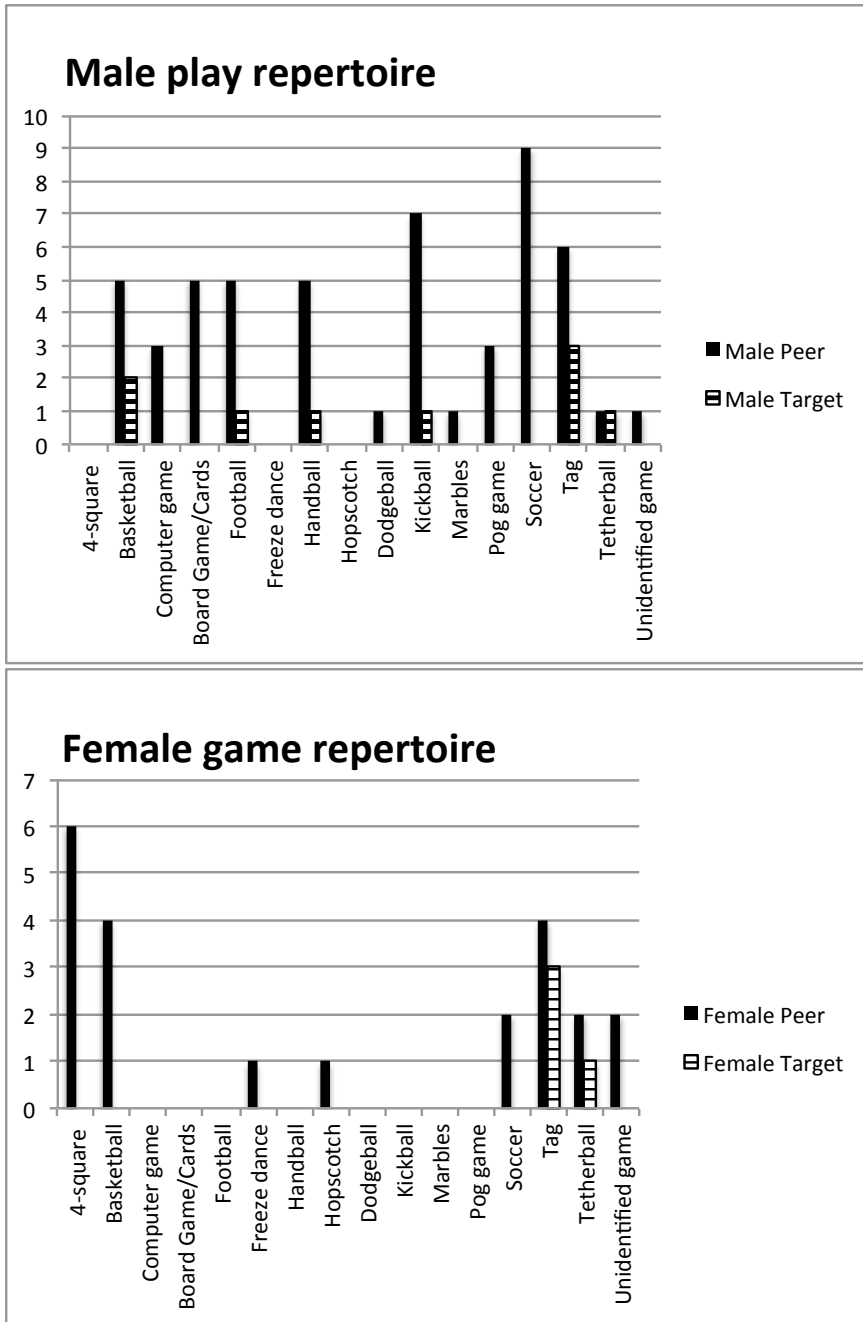


Figure 3. The unstructured activities that boys and girls with and without ASD played at school.

Girls		Boys	
Typically Developing (n=30)	ASD (n=17)	Typically Developing (n=16)	ASD (n = 7)
Jungle gym (9)	Jungle gym (7)	Jungle gym (5)	Jungle gym (4)
Jump-rope (6)	Jump rope (3)	Jump rope (2)	Pretend play (1)*
Swinging (5)	Pretend play (3)*	Art project (1)	Making a fort (1)
Pretend play (4) *	Hand play games (1)	Homework (1)	Jump rope (1)
Monkey bars (3)	Massage friends (1)	Leggos (1)	
Coloring (2)	Running (1)	Mad libs (1)	
Digging with twigs (2)	Sand box (1)	Playing in snow (1)	
Writing on white board (1)		Pretend play (1)*	
Sandbox (1)		Running (1)	
Reading books (1)		Sand box (1)	
Cart Wheels (1)		Snow ball fight (1)	

\*There were gender differences in the pretend play themes: TD Girls = house, painting nails, hairdresser, horses; ASD Girls = house, singing and dancing rehearsal, treasure hunt; TD boys: Action figures; ASD boys = secret agents.

## Appendix

Gender coding: Operationalized terms definitions and examples

Term		Definition	Examples
Conversation	Peer	Is talking with/in a conversation with a peer	With three friends engaged in conversation. Surrounded by others. Smiling  Sitting squished in a group of friends (15+ kids). Talking with girl next to her. Laughing, having a good time.
	Adult	Is talking with/in a conversation with an adult	Talking to dad who brought her lunch  Still at the table with just two aides. no other kids around. Eating snack and talking to his aide. Smiling. Another aide talks to him.
Social group structure	Group	Is hanging out (talking or playing, in a game) with two or more peers	Walking with 2 other girls, talking and smiling  Is hanging out (talking or playing, in a game) with three or more peers
	Dyad	Is hanging out (talking, playing, in a game) with only one other peer	Walking to the apparatus with his classmate, and started playing on the monkey bars.  Walking and talking with one other girl.
	Alone	Is by themselves, not with any peers or adults	Dribbling basketball by him self.  Walks to library and sits at the computer alone. Logs in and then walks to table and sits down. Takes off his jacket.
	Near group	Is alone, but in close proximity to a group	Eating lunch by her self. One girl sitting two chairs away from her.  Walked away from the girls, near a crowd of boys who are standing around. No talking neutral affect.
Social activity	Socializing	Is in a group or with a peer and they are talking/chit chatting.	Talking with one girl  Talking to girl sitting next to her smiling and laughing
	Game	Jointly engaged in a game with one or more peer	8 kids; playing kickball  6 boys, playing basketball; short break and then back to game
	Unstructured	Doing an activity with peers, but there are no clear rules that must be followed.	2 boys, 1 girl, playing with snow, building something On swings with 3 girls singing songs; watching 2 girls play; flat affect
	Quiet	Doing a quiet activity (e.g. reading a book, doing homework)	1 girl; coloring at desk  Sitting at table reading textbook. Sitting on edge of bench. Female peer to right. No interaction.

## References

- AIR-B (in progress). A multisite randomized trial of two social skills interventions for children with ASD in schools.
- Adler, P.A., Kless, S.J., Adler, P. (1992). Socialization to gender roles: Popularity among elementary school boys and girls. *Sociology of Education*, 65, (3), 169-187.
- Arms, E., Bickett, J., & Graf, V. (2008). Gender bias and imbalance: Girls in US special education programmes. *Gender and Education*, 20, (4), 349-359.
- Attwood T., (2006). The pattern of abilities and development of girls with Asperger's syndrome. Asperger's and girls. Arlington, TX: Future Horizons, Inc.
- Attwood, T. (2007). *The complete guide to Asperger's syndrome*. London, England: Jessica Kingsley.
- Baron-Cohen, S., Knickmeyer, R.C., Belmonte, M.K. (2005). Sex Differences in the brain: Implications for explaining autism. *Science*, 310, (5749), 819-823.
- Baron-Cohen, S. (1999). The extreme male brain theory of autism. *Trends in cognitive Sciences*, 6, (6), 248-254.
- Baron-Cohen, S., Richler, J., Bisarya, D., Gurunathan, N. & Wheelwright, S. (2003). The systemizing quotient: An investigation of adults with Asperger syndrome or high-functioning autism, and normal sex differences.
- Baron-Cohen, S. & Wheelwright, S. (2004). The empathy quotient: An investigation of adults with Asperger syndrome or high functioning autism, and normal sex differences. *Journal of Autism and Developmental Disorders*, 34,(2) 163-175.
- Bauminger, N., & Kasari, C. (2000). Loneliness and friendship in high-functioning children with autism. *Child Development*, 71(2), 447-456.
- Bauminger, N. (2002). The facilitation of social-emotional understanding of social interaction in high-functioning children with autism: Intervention outcomes. *Journal of Autism and Developmental Disorders*, 32, (4), 284-298.
- Bauminger, N. & Schulman, C. (2003). The development and maintenance of friendship in high-functioning children with autism: Maternal perceptions. *Autism*, 7(1), 81-97.
- Berenbaum, S. A., & Bailey, J.M. (2003). Effects on gender identity of prenatal androgens and genital appearance: Evidence from girls with congenital adrenal hyperplasia. *Journal of Clinical Endocrinology and Metabolism*, 88,(3), 1102-1106.
- Berenbaum, S. A., & Resnick, S. M. (2007). [The seeds of career choices: Prenatal sex hormone effects on psychological sex differences](#). In S. J. Ceci & W. M. Williams

- (Eds.), *Why aren't more women in science?* (pp. 147-157). Washington DC: APA Books.
- Blatchford, P. Baines, E. & Pellegrini (2003). The social context of school playground games: Sex and ethnic differences, and changes over time after entry to junior school. *British Journal of Developmental Psychology*, *21*, 481-505.
- Bolte, S., Duketis, E., Poustka, F., Holtmann, M. (2011). Sex differences in cognitive domains and their clinical correlates in higher-functioning autism spectrum disorders. *Autism*, *15*(4),
- Buhs, Eric S.; Ladd, Gary W.; Herald, Sarah L. (2006). Peer exclusion and victimization: Processes that mediate the relation between peer group rejection and children's classroom engagement and achievement? *Journal of Educational Psychology* *98* (1),1-13.
- Carter, A.S., Black, D.O., Tewani, S., Connolly, C.E., Kadlec, M.B., Tager-Flusberg, H. (2007). Sex differences in toddlers with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, *37*, 86-97.
- Chamberlain, B., Kasari, C., & Rotheram-Fuller, E. (2007). Involvement or isolation? The social networks of children with autism in regular classrooms. *Journal of Autism and Developmental Disorders*, *37*(2), 230-242.
- Colarossi, L. G. (2001). Adolescent gender differences in social support: Structure, function and provider type. *Social Work Research*, *25*(4), 233-241.
- Coles, E.K., Slavec, J., Bernstein, M., Baroni, E. (2012). Exploring the gender gap in referrals for children with ADHD and other disruptive behavior disorders. *Journal of Attention Disorders*, *16*(2), 101-108.
- Corsaro, W.A. & Eder, D. (1990). Children's Peer Cultures. *Annual Review of Sociology*, *16*, 197-220.
- Crick, N. R. (1997). Engagement in gender normative versus gender nonnormative forms of aggression: Links to social-psychological adjustment. *Developmental Psychology*, *33*,
- Dean, M., Fox, G.A., Kasari, C. (2013). How narrative difficulties build peer rejection: A discourse analysis of a girl with ASD and her female peers.
- Dhuey, E. and Lipscomb, S. (2010). Disabled or young? Relative age and special education diagnosis. *Economics of Education Review*, *29*, 857-872.
- Ehler, S., Gillberg, C., & Wing, L. (1999). A screening questionnaire for asperger syndrome other high-functioning autism spectrum disorders in school age child. *Journal of Autism and Developmental Disorders*, *29*, (2), 129-139.



- Ehrhardt, A.A. & Baker, S. (1974). Fetal androgen, human central nervous system differentiation, and behavior sex differences. In R.C. Friedman, R.M. Richart, and R.L. Vane Weile (Eds). *Sex Differences in Behavior*: New York: John Wiley.
- Fombonne, E. (2003). Epidemiological surveys of autism and other pervasive developmental disorders: An update. *Journal of Autism and Developmental Disorders*, 33(4), 365-382.
- Fombonne, E. (2009). Epidemiology of pervasive developmental disorders. *Pediatric Research*, 65, (6), 591-598.
- Goodwin, M.H. (2002). Exclusion in girls' peer groups: Ethnographic analysis of language practices on the playground. *Human Development*, 45, 392-415.
- Goodwin, M. H. (2006). *The hidden life of girls: Games of stance, status, and exclusion*. Malden, MA: Blackwell.
- Hall, J.A. (2010). Sex differences in friendship expectations: A meta-analysis. *Journal of Social and Personal Relationships*, 28, (6), 723-747.
- Hartley, S.L., & Sikora, D.M. (2009). Sex differences in autism spectrum disorder: An examination of developmental functioning, autistic symptoms, and coexisting behavior problems in toddlers. *Journal of Autism and Developmental Disabilities*, 39, 1715-1722.
- Hattier, M.A., Matson, J.L., Tureck, K., Horovitz, M. (2011). The effects of gender and age on repetitive and/or restricted behaviors and interests in adults with autism spectrum disorders and intellectual disability. *Research in Developmental Disabilities*, 5,(4), 2346-2351.
- Howlin, P., Mawhood, L. & Rutter, M. (2000). Autism and developmental receptive language disorder: A follow-up comparison in early adult life. *Journal of Child Psychology and Psychiatry*, 41, (5), 561-578.
- Hughs, J.N. & Kwok, O. (2006). Classroom engagement mediates the effect of teacher-student support on elementary students' peer acceptance: A prospective analysis. *Journal of School Psychology*, 43, 465-480.
- Jordan-Young, R. (2010). *Brainstorm: The flaws in the science of sex differences*. Cambridge, Massachusetts: First Harvard University Press.
- Kanne, S.M., Abbacchi, A.M., & Constantino, J.N. (2009). Multi-informant ratings of psychiatric symptom severity in children with autism spectrum disorders: The importance of environmental context. *Journal of Autism and Developmental Disorders*, 39, 856-864.

- Kasari, C., Chamberlain, B., & Bauminger, N. (2001). Social emotions and social relationships: Can children with autism compensate? *Journal of Autism and Developmental Disabilities*,
- Kasari, C., Locke, J. Gulsrud, A. Rotherman-Fuller, E. (2010). Social networks and friendships at school: Comparing children with and without asd. *Journal of Autism and Developmental Disabilities*, 41, (5), 533-544.
- Khan, S.A., Faraone, S.V. The genetics of attention-deficit/hyperactivity disorder: A literature review of 2005. *Current Psychiatry Reports*, 2006 Oct; 8:393-397.
- Knickmeyer, R. C., Wheelwright, S. & Baron-Cohen, S. (2007). Sex-typical play: Masculinization/defeminization in girls with autism spectrum condition. *Journal of Autism and Developmental Disorders*, DOI: 10.1007/s10803-007-0475-0.
- Koenig, K. & Tsatsanis. K. (2005) Pervasive developmental disorders in girls. In Deborah Bell-Dolan, Sharon L. Foster & Eric J. Mash (Eds.) Behavioral and emotional problems in girls. New York: Kluwer Academic/Pleum Press.
- Kopp, S., Gillberg, C. (2011) The autism spectrum screen questionnaire (assq)- revised extended version (assq-rev): An instrument for better capturing the autism phenotype in girls? A preliminary study involving 191 clinical cases and community controls. *Research in Developmental Disabilities*
- Kopp, S. Gillberg, Beckung, E. & Gilberg, C. (2010). Developmental coordination disorder and other motor control problems in girls with autism spectrum disorder and/or attention-deficit/hyperactivity disorder. *Research in Developmental Disabilities*, 31, 350-361.
- Kopp S, Gillberg C (1992) Girls with social deficits and learning problems: Autism, atypical asperger syndrome or a variant of these conditions. *European Child & Adolescent Psychiatry*, 1, 89–99.
- Kozlowski, A. M., Matson, J. L., & Rieseke, R. D. (2012). Gender effects on challenging behaviors in children with autism spectrum disorders. *Research in Autism Spectrum disorders*, 6, (2), 958-964.
- Lai, M., Lombardo, M. V., Pasco, G., Ruigrok, A. N. V., Wheelwright, S. J., Sadek, S. A., MRC AIMS Consortium, Baron-Cohen, S. (2011). A Behavioral Comparison of Male and Female Adults with High Functioning Autism Spectrum Conditions. *PLoS ONE*, 6, 1-10.
- Locke, J., Ishijima, E.H., Kasari, C. & London, N. (2010). Loneliness, friendship quality and the social networks of adolescents with high-functioning autism in an inclusive school setting. *Jornal of Research in Special Educaiotn Needs*. 10(2), 74-81.

- Ladd, G.W., Kochenderfer, B.J., & Coleman, C.C. (1996). Quality as a predictor of young children's early school adjustment. *Child Development, 67*,(3), 1103-1118.
- Lord, C. (1982). Sex differences in autism. *Journal of Autism and Developmental Disorders, 27*, (5), 621-626.
- Lord, C., Risi, S., Lambrecht, L., Cook, E.H., Leventhal, B.L., DiLavore, P.C., Pickles, A., Rutter, M.(2000). The autism diagnostic observation schedule-generic: A standard measure of social communication deficits associated with the spectrum of autism. *Journal of Developmental Disorders, 30*, (3), 205-223.
- Lord, C., Rutter, M., DiLavore, P.C., & Risi, S. (2002). *Autism Diagnostic Observation Schedule -Generic*. Los Angeles: Western Psychological Services.
- Maccoby, E.E., & Jacklin, C.N., (1974), *The psychology of sex differences*. Stanford, California: Stanford University Press.
- Maccoby, E. E., (1988). Gender as a social category. *Developmental Psychology, 24*(6), 755-765.
- Maccoby, E.E., (1990). Gender and relationships: A developmental account. *American Psychologist, 45*,(4), 513-520.
- Maccoby, E.E., (1999). *The two sexes: Growing up apart coming together*. Cambridge, Massachusettes:First Harvard University Press.
- Maccoby, E.E., (2002). Gender and group process: A developmental perspective. *Current Directions in Psychological Science, 11*(2), 54-58.
- Mandy, W., Chilvers, R., Chowdhury, U., Salter, G., Siegal, A., & Skuse, D. (23 September, 2011.) Sex differences in autism spectrum disorder: Evidence from a large sample of children and adolescents. *Journal of Autism and Developmental Disorders*. Advance online publication.
- Manwaring, J.S. (2008). How the underrepresentation of girls impacts gender roles in preschool special education. *Teaching Exceptional Children, 40*, (5), 60 - 65.
- Mazurek, M.O. and Kanne, S. (2010). Friendship and Internalizing Symptoms among Children and Adolescents with ASD. *Journal of Autism and Developmental Disorders, 40* (12), 1512-1520.
- McIntyre, T. & Tong, V., (1998). Where the boys are: Do cross-gender misunderstanding of language use and behavior patters contribute to the overrepresentation of males in programs for students with emotional and behavioral disorders? *Education and Treatment of Children, 21*,(3) , 321-332.

- Pellegrini, A.P., Blatchford, P., Kentaro, K; Ed Baines (2004). A Short-term Longitudinal Study of Children's Playground Games in Primary School: Implications for Adjustment to School and Social Adjustment in the USA and the UK., *Social Development*, 13(1), 107-123.
- Pilowsky, T., Yirmiya, N. Shulman, C. & Dover, R. (1998). The autism diagnostic interview-revised and the childhood autism rating scale: differences between diagnostic systems and comparison between genders. *Journal of autism and developmental disorders*, 28, (2), 143-151.
- Robertson, K., Chamberlain, B. & Kasari, C. (2003). General education teachers' relationships with included students with autism. *Journal of Autism and Developmental Disorders*, 33, (2), 123-133.
- Rotheram-Fuller, E., Kasari, C., Chamberlain, B., & Locke, J. (2010). Social involvement of children with autism spectrum disorders in elementary school classrooms. *Journal of Child Psychology and Psychiatry*, 51(11):1227-1234.
- Rutter, M., Bailey, A., & Lord, C. (2003). *Social Communication Questionnaire-WPS SCQ-WPS*. Los Angeles, CA: Western Psychological Services.
- Servin, A., Nordenstrom, A. Larsson, A., & Bohin, B. (2003). Prenatal androgens and gender-typed behavior: A study of girls with mild and severe forms of congenital adrenal hyperplasia. *Developmental Psychology*, 39, (3), 440-450.
- Scuitto, M.J., Nolfi, C.J., & Bluhm, C., (2004). Effects of child gender and symptom type on referrals for ADHD by elementary school teachers. *Journal of Emotional and Behavioral Disorders*, 12 (4), 247-253.
- Shattuck, P.T., Durkin, M., Maenner, M., Newschaffer, C., Mandell, D.S., Wiggins, L., Lee, L. Rice, C., Giarelli, E., Kirby, R., Baio, J., Pinto-Martin, J., Cuniff, C. (2009). Timing of identification among children with an autism spectrum disorder: Findings from a population-based surveillance study. *Journal of American Academy of Child and Adolescent Psychiatry*, 48:5, 474-483.
- Sipes, M. Matson, J.L., Worley, J.A., Kozlowski, A.M. (2011). Gender differences in symptoms of autism spectrum disorders in toddlers. *Research in Autism Spectrum disorders*, 5, (4), 1465-1470.
- Solomon, M., Miller, M.m Taylor, S.L., Hinshaw, S.P. & Carter, C.S. (2012). Autism symptoms and internalizing psychopathology in girls and boys with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, 42, 48-59.
- Stinnett, T.A., Bull, K.S., Koonce, D.A. & Aldridge, J.O. (1999). Effects of diagnostic label, race, gender, educational placement, and definitional information on prognostic outlook for children with behavior problems, *Psychology in the Schools*, 36, (1), 51-59.

- Swenson, L.P., Rose, A.J., (2009). Friends' Knowledge of youth internalizing and externalizing adjustment: Accuracy, bias, and the influences of gender, grade, positive friendship quality, and self-disclosure. *Journal of Abnormal Child Psychology*, 37:887-901.
- Szatmari, P., Archer, L., Fisman, S., & Streiner, D.L. (1994). Parent and teacher agreement in the assessment of pervasive developmental disorders. *Journal of Autism and Developmental Disorders*, 24, (6), 703-717.
- Teddlie, C., & Tashakkori, A. (2009). *Foundations of mixed methods research: integrating quantitative and qualitative approaches in the social and behavioral sciences*. Los Angeles: SAGE.
- Tsai, L., Stewart, M., & August, G. (1981). The development of sex differences in infantile autism. *The Britishe Journal of Psychiatry*, 14(142(4), 373.
- Volkmar FR, Szatmari P, Sparrow SS (1993) Sex differences in pervasive developmental disorders. *Autism Dev Disord* 23: 579–591.
- Wiggins, L.D., Baio, J., Rice, C. (2006). Examination of the time between first evaluation and first autism spectrum diagnosis in a population-based sample. *Developmental and Behavioral Pediatrics*, 27, (2), S79-S87.

Wing, L., Gould, J. Gillberg, C. (2011). Autism spectrum disorders in the dsm-v: Better or worse than dsm-iv?, *Research in Developmental Disabilities*, 32(2), 768-773.

Youngstrom, E., Loeber, R., & Stouthamer-Loeber, M. (2000). Patterns and correlates of agreement between parent, teacher, and male adolescent ratings of externalizing and internalizing problems. *Journal of Consulting and Clinical Psychology*, 68(6), 1038-1050.