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Gender Differences in Internalizing Problems and Everyday Behaviors Associated with Executive Function in Children and Adolescents with Autism Spectrum Disorder

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GENDER DIFFERENCES IN INTERNALIZING PROBLEMS AND EVERYDAY BEHAVIORS ASSOCIATED WITH EXECUTIVE FUNCTION IN CHILDREN AND ADOLESCENTS WITH AUTISM SPECTRUM DISORDER

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Abstract

Background: Many children with autism spectrum disorder (ASD) experience internalizing problems, and there was evidence suggesting that poor executive function (EF) predicted their internalizing problems. However, this association was primarily found in studies with male children with ASD. Therefore, the present study aimed to investigate gender differences in internalizing problems and everyday EF in ASD children (age 5-15) and examined the associations between internalizing problems and everyday EF.

Method: This study examined neuropsychological assessment data of ASD children without intellectual disability. The study consisted of two groups: 1. ASD boys (n = 44), 2. ASD girls (n = 15). The study examined gender differences in internalizing problems and everyday EF using one-way multivariate analysis of covariance, and the associations between the two variables were examined using third-order partial correlation analysis.

Results: The study showed that a considerable number of ASD children had challenges related to internalizing problems and everyday EF. Furthermore, a significant gender difference was found in everyday EF, such that ASD girls had significantly more problems with behavior regulation than ASD boys. Lastly, a significant association was found only between behavior regulation and depressive problems, while emotion regulation did not have significant associations with internalizing problems in the sample.

Conclusions: This study demonstrated potential gender differences in ASD-related challenges, and many ASD children require interventions specifically targeting underlying factors influencing emotional and behavioral challenges in school settings.

Keywords: autism spectrum disorder, executive function, behavior rating inventory of executive function, anxiety problems, depressive problems, internalizing problems

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Chapter 1: Introduction

Autism spectrum disorder (ASD) is a neurodevelopmental condition characterized by impairments in social communication and interaction, along with the presence of restricted interests or activities. Individuals with ASD show some of these core ASD symptoms from early childhood, though the manifestations and severity of the symptoms may vary from individual to individual (American Psychiatric Association, 2022). It is indicated that ASD children and adolescents are at a higher risk of experiencing several challenges and stressors than their neurotypical peers, due to their social difficulties such as experiencing isolation and being bullied (Attwood, 2006; Roberts & Simpson, 2016). This can create further emotional and behavioral problems (Maskey et al., 2013). Therefore, ASD students have complex needs and may require significant support in school. Unfortunately, however, the educational outcomes of ASD students are poor (Ashburner et al., 2010) because many of them develop co-occurring psychological conditions, such as anxiety (Adams et al., 2018; Eussen et al., 2012; Mayes et al., 2011), depression (DeFilippis, 2018; Wigham et al., 2017), oppositional behaviors (Mattila et al., 2010), and aggression (Maskey et al., 2013).

Furthermore, it is reported that general classroom educators have limited knowledge about ASD and effective teaching strategies (Roberts & Simpson, 2016). Hence, ASD students experience academic underachievement more than their neurotypical peers (Ashburner et al., 2010). Therefore, mental health experts at school, such as school psychologists, need to collaborate with educators, in order to identify students' challenges and provide appropriate services for ASD students. Regrettably, even though school psychologists are well equipped to serve ASD students in school settings, a national survey of school psychologists indicated that many of them do not engage in evidence-based assessment practices (i.e., conducting a

comprehensive assessment) or evaluation of other factors (e.g., co-occurring emotional and behavioral problems) that could significantly affect intervention decisions for ASD students (Aiello et al., 2017). There is a strong need for school psychologists to evaluate each student's unique characteristics and challenges, so as to implement effective interventions.

Greater ASD research is essential in the field of school psychology for two reasons: (a) an increased understanding of various manifestations and unique presentations of ASD symptoms is vital to school psychologists' practice, so as to assess the disorder accurately, and (b) elucidating additional factors associated with ASD-related problems could lead to better implementation of evidence-based interventions and services for ASD students. Previous literature proves that anxiety and depressive problems in ASD children were related to executive dysfunction (e.g., Gardiner & Iarocci, 2018; Gotham et al., 2015; Lawson et al., 2015; Lieb & Bohnert, 2017; Vogan et al., 2018). Hence, executive dysfunction in ASD children could be a predictive factor for developing internalizing problems.

This dissertation aimed to examine internalizing problems (i.e., anxiety and depressive problems) and everyday executive function (EF) in ASD children and adolescents. In addition, this study examined gender differences in internalizing problems and everyday EF. This is because very few studies have examined gender differences in internalizing problems and executive dysfunction in the ASD population (Hartley & Sikora, 2009; Mandy et al., 2012; Oswald et al., 2016; Solomon et al., 2012). Therefore, this study sought to answer the following specific research questions:

1. Do boys and girls with ASD differ in their levels of internalizing problems (i.e., anxiety and depressive problems)?

2. Do boys and girls with ASD differ in their levels of problems with everyday EF (i.e., behavior and emotion regulation)?
3. Are problems in everyday EF associated with internalizing problems (i.e., anxiety and depressive problems) in children and adolescents with ASD?

In this chapter, the significance of the research problem is first discussed. Next, the chapter defines internalizing problems and describes co-occurring internalizing problems in ASD children and adolescents. Subsequently, the chapter briefly discusses the concept of EF and executive dysfunction theory, which captures ASD-related symptoms associated with EF impairments. Further, this chapter also reviews some of the neuropsychological performance-based assessments of EF and the behavior rating scales of everyday behaviors associated with EF. The association between internalizing problems and executive dysfunction in ASD is also explored, in the context of current research findings. Finally, this chapter discusses gender differences in internalizing problems and executive dysfunctions among ASD children, thereby outlining the problem statement of this dissertation study.

Significance of the Problem

Ever since the Individuals with Disabilities Education Act (IDEA) 2004 was enacted, there has been a greater commitment towards providing education in the least restrictive environment (LRE) to every child with a disability. Today, more students with disabilities receive their education in general education classrooms in the United States. It is estimated that approximately 91% of students availing special education services under the eligibility category of autism receive at least 40% of their education in general education classrooms, and about 40% of them spend 80% or more of their time in general education settings (National Center for Education Statistics, 2019). Although it is reported that inclusive practice has benefited ASD

students availing special education services, many of them are also facing additional challenges such as social problems (Sedgewick et al., 2016), peer victimization (Kloosterman et al., 2014), and a lack of understanding of the disorder from teachers and peers (Roberts & Simpson, 2016). As a result, research suggests that ASD students are more likely to experience internalizing problems compared to their neurotypical peers (Adams et al., 2019; Andersen et al., 2015; Duvekot et al., 2018; Eussen et al., 2013; Lieb & Bohnert, 2017; Mayes et al., 2011; Solomon et al., 2012; van Steensel & Heeman, 2017; Wigham et al., 2017). It is vital that school psychologists assess any risk factors predictive of students' psychological problems using ecologically valid assessments, in order to capture various perspectives on their challenges.

Further, several students clinically diagnosed with ASD do not receive special education services in school settings within the United States. For example, it is reported that 42% lesser boys and 88% lesser girls with ASD than the ASD prevalence suggested by the Center for Disease Control and Prevention (CDC) received special education services under the eligibility category of autism in school settings (Barnard-Brak, 2019). In other words, the number of ASD students in school settings is much greater than those actually receiving special education services. Since the presentation of symptoms in ASD students can be remarkably heterogeneous, not all ASD students require the same level of services or support from schools. Therefore, school psychologists need to have an in-depth understanding of the various characteristics and manifestations of ASD students, in order to provide evidence-based intervention that is specifically tailored to each ASD student.

Given the above context, this dissertation investigated internalizing problems in ASD children and adolescents and examined if executive dysfunction could be a potential risk factor predictive of internalizing problems.

Internalizing Problems in ASD

The term *internalizing problems* is used to describe a broader dimension of behavioral and emotional problems, as research shows statistical associations among a cluster of syndromes due to overlapping symptoms (Achenbach & Edelbrock, 1978). Some examples of internalizing problems include anxiety, depression, and somatic complaints, as these symptoms have demonstrated significant positive associations with each other (Achenbach & Edelbrock, 1978; Brady & Kendall, 1992). Due to high correlations between anxiety and depressive problems, these problems are often investigated together as internalizing problems in the ASD population (e.g., Lawson et al., 2015; Maskey et al., 2013; Mayes et al., 2011; Mayes, Calhoun, Murray, Morrow, et al., 2011; Mazurek & Kanne, 2010; Strang et al., 2012; Vogan et al., 2018).

Lesser number of ASD studies examine anxiety problems (e.g., Duvekot et al., 2018; Eussen et al., 2012; Kerns et al., 2014; Renno & Wood, 2013; Wijnhoven et al., 2018) and depressive problems (e.g., Andersen et al., 2015; Bitsika & Sharpley, 2015; Lieb & Bohnert, 2017) as discrete variables within a study. When anxiety and depressive problems are investigated separately, it is found that not all ASD children experience both anxiety and depressive problems together (e.g., Mayes, Calhoun, Murray, Ahuja, et al., 2011; Strang et al., 2012). For example, participants with ASD are seen to be more anxious but not depressed (Mayes, Calhoun, Murray, Ahuja, et al., 2011). In addition, Hollocks et al. (2014) indicate that anxiety problems were significantly related to participants' executive dysfunction, whereas; however, depressive problems did not have strong associations with executive dysfunction. Thus, the aforementioned studies suggest that the underlying mechanisms of anxiety and depressive problems in ASD children and adolescents might vary. Therefore, further studies are needed to investigate anxiety and depressive problems as separate constructs within the ASD population.

As ASD children and adolescents face several social challenges associated with ASD symptoms (e.g., difficulty in maintaining meaningful friendships and engaging in social or emotional interactions), their anxiety and depressive problems could be viewed as normal reactions to significant environmental stressors. Prevalence estimates vary; however, approximately 40% of ASD children and adolescents are reported to have a clinically elevated level of anxiety problems or at least one co-occurring anxiety disorder (van Steensel et al., 2011). Also, between 1.4% to 26% of ASD children and adolescents are reported as suffering from a clinically elevated level of depression (DeFilippis, 2018, for review). Although early identification of internalizing problems is crucial, evaluation of internalizing problems can be challenging in ASD children and adolescents, due to their lack of insight into their emotional experiences. Some studies also argue that it is difficult to determine whether internalizing problems should be viewed as a core or as a secondary feature of ASD (MacNeil et al., 2009, for review).

Researchers have used a variety of assessment methods to examine internalizing problems in the ASD population, such as clinical interviews based on the Diagnostic and Statistical Manual of Mental Disorders (DSM; American Psychiatric Association, 2013) criteria, direct observation, and physiological measures (MacNeil et al., 2009). Additionally, behavior rating scales (parent, self, and teacher reports) have been widely used to measure internalizing problems in ASD children and adolescents (e.g., Duvekot et al., 2018; Eussen et al., 2012; Kerns et al., 2014; Mayes et al., 2011; Mazurek & Kanne, 2010; Strang et al., 2012; Wijnhoven et al., 2018). The advantage of using a behavior rating scale to assess internalizing problems in ASD is that it requires lesser time to complete the scale compared to a diagnostic clinical interview. Nonetheless, it shows good diagnostic accuracy in detecting the presence of anxiety or

depressive problems in individuals with ASD (Magyar & Pandofli, 2017). Some of the widely used behavior rating scales for anxiety and depressive problems in ASD are the Achenbach System of Empirically Based Assessment [e.g., the Child Behavior Checklist (CBCL; Achenbach & Ruffle, 2001)], the Behavior Assessment System for Children Rating Scale (BASC; Reynolds & Kamphaus, 2004), the Child and Adolescent Symptom Inventory (CASI; Gadow & Sprafkin, 2002), and the Developmental Behavior Checklist (DBC; Einfeld & Tonge, 1995).

Anxiety Problems

Studies on anxiety problems in ASD children suggest that these children have much higher anxiety levels than their neurotypical peers (e.g., Adams et al., 2019; van Steensel & Heeman, 2017). The differences in anxiety problems between ASD children and typically developing (TD) children are significant ($d = 0.78$). This indicates that ASD children seem to be significantly more likely to experience anxiety problems than TD children (van Steensel & Heeman, 2017). Moreover, these ASD children suffering from anxiety problems are at an increased risk of experiencing a range of secondary problems that could create academic and social difficulties. For example, it is reported that co-occurring anxiety is more likely to exacerbate symptoms of autism (White et al., 2014), social communication challenges (Duvekot et al., 2018), and peer victimization (Eussen et al., 2013). Specifically, Duvekot et al. (2018) examines ASD children's anxiety problems using the CBCL. They find that high anxiety significantly contributes to increased levels of social communication impairment over time. Eussen et al. (2012) also show that ASD children with social relationship challenges experience high levels of anxiety problems, as measured by the CBCL, resulting in an increased risk of experiencing negative peer interactions, such as bullying (Eussen et al., 2013). Thus, previous

research suggests that anxiety problems in ASD children could become an additional barrier in engaging with their peers in social situations, thereby further reducing opportunities to practice their social skills.

Depressive Problems

As in the case of anxiety problems, several ASD children and adolescents are also reported to have higher levels of depressive problems compared to their neurotypical peers. For example, Strang et al. (2012) show that depressive problems in their ASD samples are much higher than in the general population; 44% of their sample was either in the borderline clinical range or clinical range for depressive problems as measured by the CBCL. Another study uses the CASI to examine the severity of depressive problems in the ASD sample, and to compare it with a neurotypical control group (Bitsika & Sharpley, 2015). In this study, 47% of their ASD sample met the DSM criteria for major depressive disorder (MDD), whereas only 3.9% of their control group met the DSM criteria, suggesting that ASD children and adolescents have more severe depressive problems than their peers. On the other hand, Vickerstaff et al. (2007) examine the associations between self-perceived competence and depressive problems among ASD youth. They find that self-perceived social competence is a significant predictor of depressive problems as measured by the BASC (parent, teacher, and student rating scales). This indicates that individuals with greater awareness of social difficulties experience more significant depressive problems than those without awareness of their social limitations. Thus, ASD children and adolescents experiencing depressive problems appear to have self-awareness about their lack of social competence. DeFilippis (2018) reports that depression in individuals with ASD could lead to isolation, suicidality, increased obsessions, and stereotypical and self-injury behaviors, all likely to result in further impairments in their adaptive behavior.

Summary

Overall, empirical evidence shows that ASD children and adolescents are at high risk of experiencing co-occurring internalizing problems, regardless of the assessment methods. Internalizing problems in ASD pose significant issues, because they are associated with the worsening of ASD-related symptoms and create additional social stressors in ASD students. Some of the adverse effects of internalizing problems also highlight the importance of early detection of internalizing problems in providing appropriate support and early intervention in school settings for ASD students. That being said, there still remains much to understand about why some ASD children and adolescents suffer from internalizing problems while others do not seem to experience these problems. Moreover, gender differences in internalizing problems have been proved in some studies, showing that females with ASD have higher internalizing problems than males with ASD (e.g., Hartley & Sikora, 2009; Mandy et al., 2012; Oswald et al., 2016; Solomon et al., 2012). Regrettably, most ASD research thus far has mainly focused on males with ASD, and there is a lack of understanding about females with ASD (Shefcyk, 2015). Therefore, more research is needed to understand various neurobehavioral and cognitive profiles in females with ASD, so as to provide necessary care and tailored interventions for *all* students with ASD.

It is well documented that several ASD children have impairments in EF (Hill, 2004, for review). Findings from empirical studies suggest that executive dysfunction could be a possible risk factor related to internalizing problems in the ASD population (Bloemen et al., 2018; Burrows et al., 2017; Dajani et al., 2016; Fernandez-Prieto et al., 2020; Gardiner & Iarocci, 2018; Gotham et al., 2015; Hollocks et al., 2014; Lawson et al., 2015; Lieb & Bohnert, 2017; Trimarco et al., 2020; Vogan et al., 2018). Since accurately assessing internalizing problems in

the ASD population could be difficult, risk factors and predictors associated with these problems could serve as valuable information for school psychology practitioners to provide required support to ASD students. Therefore, this dissertation investigated internalizing problems in ASD children and adolescents. Specifically, this study examined the association between internalizing problems and everyday behaviors associated with EF. It also investigated the gender differences in internalizing problems and everyday behavior associated with EF in ASD children and adolescents.

Internalizing Problems and Executive Dysfunction in ASD

It has been hypothesized that some of the symptoms of neurodevelopmental disorders (e.g., ASD, attention-deficit hyperactivity disorder, Tourette's disorder) and psychopathologies (e.g., schizophrenia, major depressive disorder, bipolar disorder, and obsessive-compulsive disorder) may be explained by patients' executive dysfunctions (Burrows et al., 2017; Dajani et al., 2016; Demetriou et al., 2019; Geurts et al., 2014; Hill, 2004; Snyder et al., 2015). EF is used as an umbrella term to describe hypothesized cognitive control processes supported by the prefrontal cortex, which are critical to navigating our daily activities (Goldstein et al., 2014). One of the influential cognitive models, executive dysfunction theory (Hill, 2004), explains that the key characteristics of ASD, both in the social and non-social domains, might be related to their EF impairments. The EF domains, wherein several individuals with ASD have deficits, are planning, cognitive flexibility, inhibition, and self-monitoring (e.g., Geurts et al., 2014; Hill, 2004; Hiller et al., 2014; Jiujias et al., 2017; LeMonda et al., 2012). Since EF plays a critical role in several important aspects of students' lives, it is no surprise then, that deficits in EF abilities can increase their risk of facing several challenges, such as academic and social problems (Kloosterman et al., 2014; Lieb & Bohnert, 2017).

Executive Function (EF) Measurements

Traditionally, EF has been assessed using performance-based neuropsychological tasks in a controlled clinical setting. For example, performance-based set-shifting tasks have been administered to assess cognitive flexibility (i.e., shifting), which is conceptualized as the shifting ability required when a person switches their perspectives and actions in a situation. Some examples of these tasks include the *Wisconsin Card Sorting Task* (Stuss et al., 2000), the *Trail Making Tests* (Army Individual Test Battery, 1944; Bowie & Harvey, 2006), and the *Tower of Hanoi* (Goel & Grafman, 1995). Another commonly assessed EF domain in the ASD population is inhibition, which is conceptualized as controlling behavior and emotion by rejecting an automatic tendency in a situation (Chung et al., 2014). The *Stroop task* (MacLeod, 1991), *Flanker task* (Eriksen & Eriksen, 1974), and *Go/No-go task* (Cragg & Nation, 2008) are some of the widely used performance-based tasks to examine inhibitory control.

Performance-based tasks have been utilized to assess EF for some time. However, as these tasks are supposed to measure each hypothesized construct of EF, researchers and clinicians question the utility of the results obtained from the tasks in everyday situations. For example, each task has varying difficulty levels of EF demands, and the disparity among tasks could make it difficult to understand, if or to what extent ASD individuals experience problems in everyday situations due to executive dysfunction. Accordingly, a meta-analysis indicates that performance-based measurements have poor clinical utility in differentiating between ASD and TD students (Demetriou et al., 2018). Furthermore, it is argued that testing EF components in a clinical setting does not represent real-world EF demand (Demetriou et al., 2018). Hence, using more ecologically valid measurements to evaluate individuals' everyday EF abilities has gained popularity in recent years. One of the widely used behavioral rating scales is the Behavior Rating

Inventory of Function (BRIEF; Gioia et al., 2015). The BRIEF is reported to have ecological validity as the scale measures everyday EF. Further, it has adequate internal consistency, interrater and test-retest reliability, as well as content, convergent and divergent validity (Gioia et al., 2015).

Association Between Internalizing Problems and Executive Dysfunction in ASD

Empirical evidence thus far suggests that executive dysfunctions might be predictors of internalizing problems in children and adolescents with ASD (Bloemen et al., 2018; Dajani et al., 2016; Fernandez-Prieto et al., 2020; Gardiner & Iarocci, 2018; Gotham et al., 2015; Hollocks et al., 2014; Lawson et al., 2015; Lieb & Bohnert, 2017; Trimarco et al., 2020; Vogan et al., 2018). Hollocks et al. (2014) investigate the association between overall EF performance in neurocognitive tasks (*Opposite World* measures inhibition, *Trail Making* measures attentional switching, the number backward task measures verbal working memory, and *Card Sorting Task* measures set-shifting) and internalizing problems (i.e., anxiety and depressive problems) measured by the Profile of Neuropsychiatric Symptoms (PONS; Santosh et al., 2006) in adolescents with ASD. The study indicates that participants' overall poor performance in EF tasks is strongly related to high levels of anxiety problems, but such a relationship is not found with depressive problems. Andersen et al. (2015) investigate the association between EF and depressive problems over the course of two years. In this study, researchers specifically investigate and measure participants' inhibitions and cognitive flexibility using the *Color-Word Interference Test*, working memory using the number sequence test, and depressive problems were measured by the CBCL. The study proves that while participants' cognitive flexibility and inhibition improve over time, their depressive problems remain the same, indicating that executive dysfunction is not directly associated with depression.

On the other hand, different outcomes are evidenced when everyday EF is measured using a behavioral scale. For example, Gardiner and Iarocci (2018) use the BRIEF to measure everyday EF in ASD children. Their results show that shift and emotional control measured by the BRIEF are strongly associated with depressive problems measured by the BASC; however, none of the BRIEF scales have any significant association with anxiety problems in their study. In contrast, Vogan et al. (2018) report different results from Gardner and Iarocci (2018) in their longitudinal study. They use the BRIEF to examine the relations among everyday EF and social, emotional, and behavioral functions, over two years, in ASD children. Their results indicate that behavior regulation problems measured by the BRIEF are significant predictors of internalizing problems (both anxiety and depressive problems) measured by the CBCL two years later.

The above mixed findings have been obtained from studies using performance-based tasks to measure EF. Studies using a behavioral rating of EF might also give the same results, as research shows no significant correlation between the performance-based tasks and behavioral measures of EF (Teunisse et al., 2012). That being said, in school psychology practice, it is essential to use ecologically valid assessments (e.g., measuring everyday behaviors associated with EF) that correspond to the real-world performance of students, in order to understand and help them deal with everyday challenges. As only a few studies so far have investigated the association between everyday EF and internalizing problems in ASD children and adolescents, more research is needed to better understand if there is an association among these variables.

Gender Differences in Internalizing Problems in ASD

Studies investigating gender differences in internalizing problems in ASD children have shown inconsistent findings. Reviews of studies examining internalizing problems in ASD indicate that ASD children have more internalizing problems compared to their neurotypical

peers. However, there is no statistically significant gender difference in internalizing problems measured by the CBCL or BASC among ASD samples, in some studies (e.g., Hull, Mandy, et al., 2017; Rivet & Matson, 2011). Nonetheless, gender differences are seen in several studies investigating internalizing problems, which are measured using a variety of scales [e.g., BASC; CBCL; The Children's Depression Inventory (CDI); Kovacs, 1992; The Revised Child Anxiety and Depression Scale (RCADS); Chorpita et al., 2000] in ASD samples. Positive gender differences are found at different ages, cognitive abilities (for example, IQ), and ASD severity levels (Howe et al., 2015; Oswald et al., 2016; Solomon et al., 2012). However, it still remains largely unclear whether these mixed findings are due to sampling biases (i.e., most participants are boys) in the studies.

Gender Differences in Executive Dysfunction in ASD

Thus far, empirical findings suggest that there may be gender differences in EF abilities in ASD children; females and males seem to have impairments in different domains of EF (Hull, Mandy et al., 2017). For example, studies using performance-based tasks to measure EF find that females with ASD perform better in the *Trail Making Tests* measuring cognitive flexibility than males with ASD (Lehnhardt et al., 2016). However, according to another study, females with ASD are seen to be more impaired in a stop task measuring inhibition ability than males with ASD (Lemon et al., 2011). On the other hand, when EF was measured using a behavioral rating of EFs (e.g., the BRIEF), females with ASD showed more significant overall EF impairments than males with ASD (White et al., 2017). Thus, EF variance between genders differed, depending on which EF measurement was used in a study, and results have been inconsistent. Moreover, most studies investigating gender differences in EF among individuals with ASD

have mainly utilized performance-based tasks. Only a few studies have examined gender differences in everyday behaviors associated with EF.

A better understanding of gender differences in internalizing problems and everyday behaviors associated with EF in ASD may allow for better assessment practice in school psychology. This is especially because clinicians need to identify students' internalizing problems as soon as possible, before the problems create further challenges. Likewise, understanding everyday EF challenges and the source of internalizing problems will serve as vital information for teachers and parents to develop effective strategies to help children. Shefcyk (2015) suggests that, when providing treatment for ASD children, it is critical to look at their challenges through ecological perspectives. Further, clinicians need to consider both extrinsic factors (e.g., social difficulty, environmental factors) and intrinsic factors (e.g., EF deficits related to their ASD symptoms), in order to address their internalizing problems. Thus, the results of this study can be beneficial to school psychology practice, because school psychologists work with teachers and parents to help identify the child's problems at the earliest and provide support and effective interventions.

Summary

The literature indicates that, ASD children are at much higher risk of developing internalizing problems (e.g., anxiety and depressive problems) than their neurotypical peers due to the social challenges associated with ASD symptoms. Internalizing problems in ASD can result in the worsening of ASD-related symptoms, because those problems could create additional social and environmental stressors in ASD children. Hence, it is critical to investigate any risk factors associated with internalizing problems in ASD children. Some empirical findings have suggested that executive dysfunction might explain the development of internalizing

problems in ASD children. However, existing studies mainly utilize performance-based tasks to measure participants' executive dysfunction, resulting in poor clinical utility and ecological validity. Therefore, using ecologically valid measurements to examine ASD children's everyday EF is essential to better understand their challenges. Additionally, gender differences may exist with reference to internalizing problems and executive dysfunction in ASD children; yet mixed findings are evidenced in studies on the ASD population. Since only a limited number of studies have investigated gender differences concerning internalizing problems and everyday behaviors in EF, it is crucial to further investigate if gender differences exist in these variables among ASD children.

Problem Statement and Delimitation of the Study

The purpose of this dissertation was twofold: a) to investigate gender differences in internalizing problems and everyday EF among a clinical sample of children and adolescents with ASD; and b) to examine the association between internalizing problems and everyday EF among a clinical sample of children and adolescents with ASD.

Since this study was interested in investigating gender differences in ASD-related problems in a clinical sample with ASD, it was delimited to a clinical sample of children and adolescents between 5 and 15 years old, with cognitive abilities of 70 or above, and with a primary diagnosis of ASD.

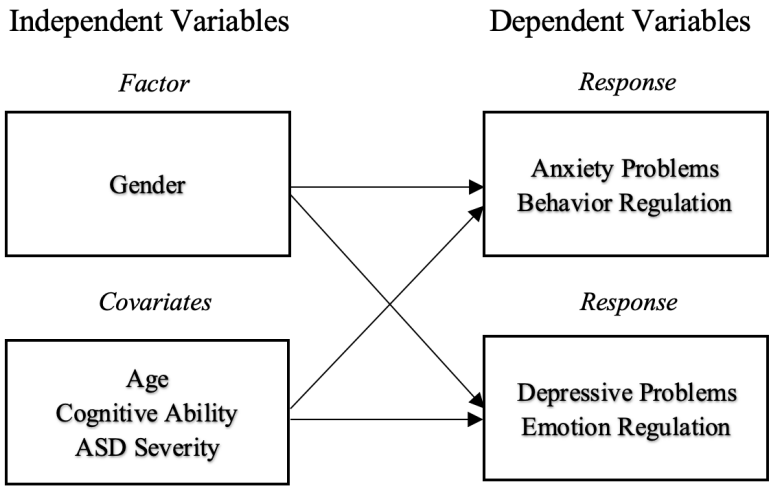
Research Questions

This study attempted to answer the following three research questions:

1. Do boys and girls with ASD differ in their levels of internalizing problems (i.e., anxiety and depressive problems)?

2. Do boys and girls with ASD differ in their levels of problems with everyday EF (i.e., behavior and emotion regulation)?
3. Do problems with everyday EF relate to internalizing problems in children and adolescents with ASD?

Figure 1
Variables and Their Relations



Chapter 2: Literature Review

Empirical evidence suggests that ASD children and adolescents are at much higher risk of developing internalizing problems than neurotypical peers (Adams et al., 2019; Bitsika & Sharpley, 2015; Strang et al., 2012; van Steensel & Heeman, 2017). Furthermore, co-occurring internalizing problems have many adverse effects, especially on those with ASD, as their internalizing problems can lead to negative social experiences and worsening ASD-related symptoms (White et al., 2014). Thus, it is crucial to understand any risk factors associated with their internalizing problems to provide effective interventions as soon as possible for students with ASD. Recent research suggests that EF deficits are one of the risk factors associated with internalizing problems (e.g., anxiety and depressive problems) in individuals with ASD (Bloemen et al., 2018; Burrows et al., 2017; Dajani et al., 2016; Fernandez-Prieto et al., 2020; Gardiner & Iarocci, 2018; Gotham et al., 2015; Hollocks et al., 2014; Lawson et al., 2015; Lieb & Bohnert, 2017; Trimarco et al., 2020; Vogan et al., 2018). However, mixed findings were evidenced in these studies investigating the association between their co-occurring internalizing problems and EF deficits, and limited studies examined if gender differences could exist in internalizing problems or EF skills in ASD children and adolescents.

Thus, a comprehensive literature review was conducted to understand what we know about the association between internalizing problems and EF deficits in ASD children and adolescents. The literature review was conducted using the university library catalog, Google Scholar, and journal databases (e.g., PsycINFO, ERIC, PsycARTICLES). The search strategy included these terms, “autism spectrum disorder” OR “ASD” OR “autism” AND “executive function” OR “executive dysfunction” OR “executive functioning” AND “anxiety” OR “anxiety problems” OR “anxiety symptoms” OR “depression” OR “depressive problems” OR “depressive

symptoms" OR "internalizing symptoms" OR "internalizing problems" AND "children" AND "adolescents." In addition, studies were included if they were peer-reviewed, written in English, published between 2010 and 2020, reported on internalizing problems (e.g., anxiety or depressive problems), and examined EF in ASD children or adolescents.

This section starts with reviewing a theory describing executive dysfunction in ASD. Then, an overview of internalizing problems in ASD children is discussed before a comprehensive literature review of studies specifically investigating the association between internalizing problems and EF deficits in ASD children and adolescents. Finally, potential gender differences in internalizing problems and EF skills are further explored.

Theoretical Framework

The following section discusses the historical background of executive function and a theory explaining EF deficits in the ASD population.

Historical Background of Executive Function Research

Executive function (EF) refers to higher-order cognitive processes supported by the prefrontal cortex, which regulates goal-directed behavior by disengaging from the immediate environment for an individual to guide actions (Diamond, 2013; Hill, 2004; Miyake et al., 2000). EF is typically used as an umbrella term for diverse hypothesized cognitive processes. Scientists discussed similar ideas and concepts to EF back in the 1840s, but EF was not formally introduced until around the 1970s (Goldstein et al., 2014). EF originated from psychologists and neuroscientists interested in understanding how the prefrontal cortex was related to intelligent behavior, and in the last century, researchers focused on examining EF through patients with frontal lobe damage (Chung et al., 2014). There have been more than 30 constructs included under the umbrella term EF since its origination (Goldstein et al., 2014); however, there is no

universal definition of EF because it is difficult to operationally define, as various theories try to explain the concept. Moreover, researchers have been challenged to understand whether EF is a unitary construct or diverse functions (Naglieri & Otero, 2014).

Today, we have several models that describe EF regarding its processes of emotions and behavioral regulations from different perspectives (e.g., cognitive, clinical, behavioral, and neurobiological), and this has created divergent theoretical frameworks to explain the mechanisms of EF (Demetriou et al., 2019). For example, some models use more narrowly defined executive functioning components (e.g., cognitive perspective), and they tend to focus on attention, action, and thought, suggesting that emotions are regulated by inhibition processes (Diamond, 2013). On the other hand, other models use a broader characterization of executive functioning (e.g., the hot-cool systems framework), hypothesizing that top-down (e.g., attentional control, problem-solving) and bottom-up processes (e.g., emotional and behavioral control) are both involved in EF (Zelazo & Carlson, 2012). In other words, these models theorize that emotion and motivation influence executive control.

To better understand whether emotions and behavioral regulations should be considered as a part of EF, neurobiological studies in humans and animals investigated the matter further, and these studies indicated that affective or motivational components seemed to be closely associated with the brain area called the orbitofrontal cortex (Chung et al., 2014 for review). However, the orbitofrontal cortex is not the area traditionally believed to be associated with EF, as it was theorized that the prefrontal cortex was primarily involved in cognitive processes related to EF. Thus, some researchers argue that affective processes influencing one's EF should not be regarded as a part of EF, while others considering the affective and motivational influence

on EF claim substantial overlap among different constructs affecting EF; therefore, EF should not be conceptualized using cognitive features (Anderson, 2002; Zelazo & Carlson, 2012).

Recent research proposed two distinct executive functions involving higher-order cognitive processes and affective and behavior regulations; EF involving top-down processes that are goal-directed and future-oriented skills are referred to as *cool* EFs, whereas *hot* EF is referred to as cognitive processes mediated by emotion and motivation (Peterson & Welsh, 2014). Many EF studies thus far investigated *cool* EFs in a variety of populations using performance-based tasks in a controlled clinical setting. Nonetheless, researchers and clinicians question the clinical utility of such measures, as most everyday situations do not occur in a controlled environment (Demetriou et al., 2018; Granader et al., 2014; Teunisse et al., 2012). On the other hand, the concept of *hot* EF has gained some popularity among EF researchers in recent years, though the validity of tasks assessing *hot* EFs has been challenged because researchers have thus far used different tasks to measure *hot* EFs making it difficult to understand whether all the tasks measured the same constructs (Peterson & Welsh, 2014 for review).

Regardless of which model researchers use to define EF, most EF models consist of these three core components of EFs; cognitive flexibility (i.e., set-shifting), inhibition (i.e., inhibitory control), and working memory (i.e., updating; Diamond, 2013; Miyake et al., 2000). These separate domains of executive functions emerged from factor analyses that investigated performance-based EF tasks in neurotypical individuals (Miyake et al., 2000). Additionally, Diamond (2013) further theorized that the core domains of executive functions might play a part in higher-order executive functions, such as reasoning and problem-solving processes (i.e., fluid intelligence). The development of core executive functioning is not linear, as different domains of EF have different developmental trajectories (Naglieri & Otero, 2014). That being said,

research shows that EF ability seems to develop throughout early adulthood as the brain continues to mature.

As mentioned, one of the common dilemmas in research investigating EF in the last few decades is related to the poor utility of EF assessments that reflect the hypothesized components of EF. Therefore, to what extent results obtained from the EF performance tasks could provide valuable information to predict actual behavioral outcomes in everyday environments seems questionable, leading to the poor ecological validity of these assessments. It is reported that the correlation between neuropsychological tests and everyday cognitive skills was only in the moderate range, which means that these test scores alone would not provide complete and accurate information about how individuals usually perform in everyday environments (Chaytor & Schmitter-Edgecombe, 2003; Teunisse et al., 2012). That is to say, even if a performance-based EF task is shown to measure a component of EF, it does not mean that the test has a good ecological validity or generalizability (Roth et al., 2014) because test performance needs to correspond to real-world performance in order to be considered as an ecologically valid test (Chaytor & Schmitter-Edgecombe, 2003). Thus, using more ecologically valid measurements (e.g., everyday behavior associated with executive functions) to evaluate individuals' everyday EF abilities has become a popular method to assess EF in the field, overcoming some of the shortcomings of performance-based tasks.

Executive Dysfunction Hypothesis

The executive function (EF) of individuals with ASD has been well studied over the last few decades. Several cognitive models have been proposed to explain the ASD-related symptoms in individuals with ASD are associated with their EF deficits. The executive dysfunction hypothesis (Hill, 2004), which focused on investigating impairments of EF in ASD,

has received substantial attention in the field as scientists tried to seek distinct executive dysfunction profiles for autism. The theory of executive dysfunction in autism explains that the key characteristics of autism, both in the social and non-social domains, are related to their EF deficits measured by neuropsychological tests (Hill, 2004). For example, it is hypothesized that behavioral problems of rigidity and perseveration experienced in individuals with ASD are explained by their executive dysfunction (Hiller et al., 2014). Accordingly, other research showed that restricted, repetitive behaviors (RRBs) in individuals with ASD were associated with their executive dysfunctions (Jiujias et al., 2017; LeMonda et al., 2012). Also, their impairments in theory of mind (ToM), which is defined as the "ability to attribute mental state to oneself and to others" (p. 124), have also been explained by their executive dysfunction in ASD (e.g., the theory of mind deficit hypothesis), suggesting that ToM and EF are highly intercorrelated (Geurts et al., 2014 for review).

Hill (2004) introduced four core components of EF, describing links between the brain and behaviors of ASD; they are planning, cognitive flexibility, inhibition, and self-monitoring. First, planning involves a complex, dynamic operation in which a child is required to plan a sequence of actions while constantly monitoring, re-evaluating, and updating them (Hill, 2004). Planning skills are related to ToM abilities, communication, social interactions, and other daily tasks, such as arriving at school on time, planning to complete homework assignments, and organizing activities (Geurts et al., 2014). It is reported that individuals with ASD, independent of ASD severity and age, tend to have impairments in neuropsychological tasks assessing planning, such as the *Tower of Hanoi* (Goel & Grafman, 1995) and the *Trail-Making B Test* (Army Individual Test Battery, 1944). Hill (2004) explains that difficulty with planning in ASD tends to show when tasks become complex; however, research produced inconsistent findings on

their planning deficits in ASD, as some individuals with ASD do not seem to have planning difficulty. It is speculated that such mixed results could be due to the heterogeneity of instruments being used to measure planning (Geurts et al., 2014).

Second, cognitive flexibility, also often referred to as mental flexibility or set-shifting, is another area of EF in which individuals with ASD have impairments (Hill, 2004). Cognitive flexibility is related to the ability to switch strategies, thoughts, or actions based on changes in a situation, and it is an especially critical skill in the everyday social environment because cognitive flexibility is required when changing perspective, behavior, or strategies (Geurts et al., 2014). It is well documented that stereotyped behaviors and preservation typically seen in ASD are a consequence of a deficit in cognitive flexibility (Geurts et al., 2014; Hill, 2004; Jiujias et al., 2017; LeMonda et al., 2012). According to Hill (2004), many individuals with ASD tend to perform poorly in performance-based tasks measuring their cognitive flexibility (e.g., *Wisconsin Card Sorting Task*), though the findings of studies using these tasks are also inconsistent. Geurts et al. (2014) explain that some tasks (e.g., switch tasks) are highly predictable, and thus, those with ASD do not show difficulties, but they tend to perform poorly with cognitive flexibility tasks involving high working memory demand. Furthermore, research suggests that verbal ability (e.g., verbal IQ) might affect their perseverative ability and that those with higher verbal ability seem to perform better in some of the cognitive flexibility tasks (Hill, 2004).

Third, inhibition is another area of EF that has been investigated in individuals with ASD. Inhibition is referred to as the ability to reject an automatic tendency in a given situation (Chung et al., 2014), and it is the ability necessary during social interactions. For example, inhibition is required when a person decides to respond with appropriate comments when they desire to say otherwise. Deficits in inhibition are well documented in other neuropsychological disorders, such

as ADHD (Antshel et al., 2014) and phenylketonuria (Trimarco et al., 2020). As far as the ASD population, research evidence inconsistent findings regarding their ability to inhibit the processing of irrelevant stimuli in ASD children. Hill (2004) indicated that ASD children seem to perform similarly or equally well compared to typically developing controls on some measures (e.g., *Go/No-Go* and *Stop-Signal* tasks). However, some individuals with ASD also showed significant impairment in some tasks involving prepotent response inhibition (*Windows Task*) and a task with high working memory demand (Geurts et al., 2014).

Lastly, self-monitoring is another component of EF investigated in individuals with ASD. Self-monitoring is a monitoring process of one's own thoughts and behaviors, and an individual evaluates if a target behavior has occurred or not using this strategy (Hill, 2004). Self-monitoring is an important function in academic success, such as increasing attention, accuracy, reading comprehension, and on-task behavior (Holifield et al., 2010). Self-monitoring has become the subject of studies in ASD because of their perseverative behavior, which seems to be associated with poor self-monitoring skills. However, the findings in the area of self-monitoring in the ASD population have been mixed. Furthermore, most tasks assessing self-monitoring skills have been developed in recent years and have not been tested by many researchers. As a result, the research provided little evidence of a specific deficit in the ability thus far (Hiller et al., 2014).

Summary

The theory of executive dysfunction explains that individuals with ASD have deficits in different domains of EF. Nonetheless, there are some limitations with previous EF research describing executive dysfunction in ASD since findings are somewhat conflicting. One of the reasons contributing to the mixed findings seems to be the inconsistent use of measurements to assess domains of EF, as not all tasks have the same difficulty assessing a similar construct. For

example, some tasks require not only a specific EF ability (e.g., cognitive flexibility) but also other areas of EF (e.g., working memory) and non-EF abilities (e.g., verbal comprehension), such that the tasks may assess broader aspects of EF (Snyder et al., 2015). In addition, based on empirical evidence, it is unclear whether most ASD individuals have impairment in some domains of EF, as Hill (2004) argues. More recent studies indicated heterogeneity in EF abilities among ASD samples, and not all individuals with ASD have executive dysfunction (e.g., Dajani et al., 2016; Geurts et al., 2014). Thus, we do not know why some individuals with ASD are impaired in some areas of EF when others do not present any EF impairments.

Another limitation of the executive dysfunction hypothesis is that most results came from studies using performance-based neuropsychological tasks to evaluate EF when they have low clinical utility in differentiating between ASD and controls, as they do not represent real-world EF demand (Demetriou et al., 2018). In school psychology practice, one of the main reasons for assessing students' abilities related to EF is to understand if they can control and direct their emotions and behaviors in a real-world environment. For such purposes, using traditional performance-based measures would not be feasible, and utilizing assessment tools with ecological validity measuring everyday behavior associated with EF becomes essential to provide helpful information to understand the student's strengths and challenges in their everyday situations. As a result, it is critical to further evaluate everyday EF in ASD children by using measures with ecological validity that may better represent the everyday situations with less structure to understand their challenges and individual differences.

Overview of Internalizing Problems in Children With ASD

ASD children in general education classrooms face many challenges in the school context. A review of research indicated that many general education teachers have limited

knowledge about autism and effective teaching strategies, and the behavior of ASD students tends to be viewed as inappropriate or disruptive in the classroom (Roberts & Simpson, 2016). When educators or peers have certain preconceived notions and expectations of students with autism, it could increase the risk of ASD students experiencing isolation or being a victim of bullying (Roberts & Simpson, 2016). Furthermore, there is a common perception that ASD students do not have a desire or the motivation to attain friendships due to their ASD symptoms (e.g., isolating themselves from their peers, a lack of ability to maintain social relationships); but empirical evidence suggests otherwise. Many ASD students value friendships similarly to neurotypical peers (Sedgewick et al., 2016) and have a strong desire to form friendships (Calder et al., 2013). That being said, a systematic review indicated that ASD students have fewer friends, contact with their friends less frequently, and are less likely to maintain a friendship than neurotypical peers (Petrina et al., 2014).

Due to limited exposure to interacting with their peers, many ASD children struggle to develop the optimal social skills required to maintain social relationships. Their lack of social experience, in turn, is likely to create additional challenges and stressors that negatively affect their quality of life and psychological well-being (Rowley et al., 2012). As a result of having significant stressors and social challenges, it is well documented that ASD children are at much higher risk of developing internalizing problems than neurotypical peers (Andersen et al., 2015; Hudson et al., 2019; Kushki et al., 2013; Rieffe et al., 2011; Strang et al., 2012; van Steensel et al., 2011; van Steensel & Heeman, 2017; Vogan et al., 2018; Wigham et al., 2017). For example, research evidenced that ASD students attending general education classrooms were particularly at high risk of having generalized anxiety symptoms (Adams et al., 2018), and when these students are aware of their social difficulties, it could lead to experiencing depression

(Vickerstaff et al., 2007). Accordingly, empirical evidence seems to suggest that internalizing problems, such as anxiety and depressive problems, could be considered a secondary consequence of social impairment and social challenges in many ASD students (Adams et al., 2019; Andersen et al., 2015; Duvekot et al., 2018; Eussen et al., 2013; Lieb & Bohnert, 2017; Mayes et al., 2011; Solomon et al., 2012; van Steensel & Heeman, 2017; Wigham et al., 2017). Thus, school psychologists must identify students' co-occurring internalizing problems to provide appropriate services and support as soon as possible.

Nonetheless, the assessment of internalizing problems in ASD is challenging and controversial. For example, some of their core symptoms of ASD (e.g., social withdrawal, difficulties adjusting behaviors) may overlap with symptoms of internalizing problems (MacNeil et al., 2009), and whether their internalizing problems should be considered comorbid disorders or a part of ASD symptoms has been a topic of debate (e.g., Kerns & Kendal, 2014; Wood & Gadow, 2010). Additionally, ASD children often have difficulty identifying or expressing their feelings and provide insufficient detail or explanations about their emotions (Losh & Capps, 2006), which could become an additional obstacle for teachers and school psychologists to identify their challenges. Thus, it is essential to gain knowledge about some of the risk factors associated with internalizing problems to prevent further negative consequences of ASD-related symptoms in ASD children.

A considerable number of studies have examined anxiety problems in ASD children and adolescents thus far. Since anxiety and depressive problems are highly correlated, many researchers investigated co-occurring symptoms of anxiety and depressive problems together as internalizing problems, while some researchers focus on examining anxiety problems or depressive problems separately in the ASD population. Nonetheless, empirical evidence suggests

that differences in levels of anxiety or depressive problems in ASD children might exist as a function of intellectual level (i.e., IQ), age, and ASD severity (Andersen et al., 2015; Eussen et al., 2013; Gotham et al., 2015; MacNeil et al., 2009; Maskey et al., 2013; May et al., 2014; Mayes, Calhoun, Murray, Morrow, et al., 2011; van Steensel et al., 2011; van Steensel & Heeman, 2017; Wijnhoven et al., 2018; Wood & Gadow, 2010).

Association Between Internalizing Problems and Cognitive Ability

With respect to depressive problems in ASD samples, a meta-analysis reveals that cognitive ability (e.g., IQ) seems to be positively associated with depressive problems, and those with higher IQ (i.e., IQ > 70) had higher levels of depressive problems than those with lower IQ (Hudson et al., 2019). Similarly, research suggests that anxiety problems and cognitive ability are also associated, though inconsistent findings have been evidenced regarding whether there is a positive or negative relationship between cognitive ability and anxiety level. For instance, several studies showed that ASD children with higher verbal IQ or full-scale IQ were significantly related to a higher risk of having anxiety problems (Gotham et al., 2015; Kim et al., 2000; Kushki et al., 2013; Mayes et al., 2011; Mazurek & Kanne, 2010; Salazar et al., 2015; Sukhodolsky et al., 2008; Wijnhoven et al., 2018) and depressive problems (Mayes, Calhoun, Murray, Morrow, et al., 2011; Vickerstaff et al., 2007). However, other studies did not indicate any significant association between cognitive ability and increased risk of having internalizing problems in ASD.

Strang et al. (2012) used the CBCL to measure participants' internalizing problems (i.e., anxiety and depressive problems together as emotional symptoms) in ASD children, and they found no association between cognitive ability and internalizing problems in their participants. On the other hand, Gotham et al. (2015) showed that participants' verbal IQ was a predictor of

anxiety problems, but depressive problems measured by the CBCL did not have any significant relationship with participants' verbal IQ. Furthermore, unlike previous studies indicating positive associations between anxiety and cognitive ability, Hollocks et al. (2014) evidenced that those with a higher IQ had lower levels of anxiety problems measured by the PONS in the ASD sample. A meta-analysis conducted by van Steensel et al. (2011) further indicated no significant difference in anxiety problems when compared to groups of ASD with an IQ less than 70 and above 70, but a significant difference was observed only in those with IQ between 70 and 87. As a result, findings on a relation between anxiety symptoms and cognitive ability are mixed in the ASD population.

Association Between Internalizing Problems and Age

Another area of research suggests that participants' age seems to be associated with an increased risk of developing internalizing problems in ASD samples. For example, Mayes et al. (2011) examined anxiety and depressive symptoms using the Pediatric Behavior Scale (PBS; Lindgren & Koeppl, 1987) in ASD children, and they showed that levels of anxiety and depressive problems increased as participants' age increased. Specifically, significantly fewer preschool children reported anxiety and depressive problems than elementary school children; however, when elementary school children were compared to middle and high school adolescents, they had much lower anxiety and depressive problems. Similar findings were reported in other studies investigating anxiety problems in ASD samples. In general, higher levels of anxiety were evidenced in studies with higher mean age, and as participants' age increased, so as their levels of anxiety problems (e.g., Gotham et al., 2015; Maskey et al., 2013; van Steensel et al., 2011; van Steensel & Heeman, 2017). That being said, some studies showed the opposite results showing that younger children had more internalizing problems than older

ASD children (Strang et al., 2012; Sukhodolsky et al., 2008; Wigham et al., 2017). As a result, we have inconclusive findings on whether or not older ASD children and adolescents are at a higher risk of experiencing internalizing problems.

Association Between Internalizing Problems and ASD Severity

ASD severity was also a factor found to be potentially associated with internalizing problems in ASD children (Andersen et al., 2015; Eussen et al., 2013; Kanne et al., 2011; MacNeil et al., 2009; Maskey et al., 2013; Mayes et al., 2011; Mazurek & Kanne, 2010; van Steensel et al., 2011; Wood & Gadow, 2010). Mayes et al. (2011) examined anxiety and depressive problems using PBS in ASD children, and the results showed that as anxiety and depressive problems increased, so did autism symptoms in their sample. Similar findings were also evidenced in other studies using different scales to measure depressive problems (the CBCL; Short Moods and Feelings Questionnaire [SMFQ], Angold et al., 1995) in ASD children, and participants' depressive problems had a significant positive interaction with the severity of ASD symptoms (e.g., Andersen et al., 2015; Kanne et al., 2009).

Nonetheless, there are also some studies evidencing conflicting results. For instance, some researchers hypothesize that ASD children acknowledging their social challenges are particularly at increased risk of developing internalizing problems, and therefore, children with less severe ASD symptoms experience higher levels of anxiety problems (Eussen et al., 2013; Maskey et al., 2013; Mazurek & Kanne, 2010). On the other hand, Strang et al. (2012) found no relationship between internalizing problems (i.e., anxiety and depressive problems measured using the CBCL) and ASD severity in their sample, showing no differences in ASD severity between a group with elevated internalizing problems and a group with non-elevated problems. Moreover, Renno and Wood (2013) also showed that the severity of ASD symptoms and anxiety

problems were not statistically significantly correlated to each other, suggesting that ASD and anxiety problems may have different constructs. Finally, Wood and Gadow (2010) hypothesized that contradictory findings in these studies might be explained by multiple underlying relations between ASD severity and internalizing problems in ASD. The researchers argue that internalizing problems in ASD could be a consequence of ASD symptoms, which results in high stress due to social challenges, or they could also be a mediator or moderator of ASD severity (Wood & Gadow, 2010).

Internalizing Problems and Executive Dysfunction in ASD

Executive dysfunction is commonly seen in individuals with ASD (Hill, 2004). The EF processes are supported by the prefrontal cortex (PFC), and social impairments in ASD are known to be associated with hypoactivation of the ventral PFC (Mazefsky & Herrington, 2014). In addition, the literature indicates that individuals with anxiety disorders also have abnormal ventral PFC function, as it plays a significant role in the inhibition of fear reactions (Blackford & Pine, 2012). On the other hand, deficits in perspective-taking have been linked to hypoactivation of the dorsomedial PFC in individuals with ASD (Mazefsky & Herrington, 2014). Furthermore, clinical patients with damage to the dorsomedial PFC also have significantly high levels of depression (Halladay et al., 2015). Thus, it is hypothesized that those individuals with ASD with EF impairments may have difficulty shifting away from their negative thoughts or distressing experience due to their hypoactivation of the PFC. In other words, children with EF deficits might be vulnerable to developing negative processing styles and cognitive strategies that could lead to internalizing problems (Hollocks et al., 2014).

Additionally, EF development is significantly influenced by one's environment and life experiences (Naglieri & Otero, 2014). Therefore, one could argue that having negative social

experiences during the critical period of brain development might have adverse consequences on how EF is being shaped. Accordingly, empirical evidence thus far supports the hypothesis that executive dysfunction in ASD may be related to internalizing problems in ASD (e.g., Bloemen et al., 2018; Burrows et al., 2017; Dajani et al., 2016; Fernandez-Prieto et al., 2020; Gardiner & Iarocci, 2018; Gotham et al., 2015; Hollocks et al., 2014; Lawson et al., 2015; Lieb & Bohnert, 2017; Trimarco et al., 2020; Vogan et al., 2018). The following section provides a comprehensive literature review of studies investigating the relationship between executive function and internalizing problems.

Different domains of EF play essential roles not exclusively in cognitive processes but also in behavioral and emotional regulations such as controlling attention and impulse, regulating unwanted thoughts, as well as inhibiting behaviors (Anderson, 2002; Eysenck et al., 2007; Hofmann et al., 2012). A lack of behavioral and emotional regulation abilities due to executive dysfunction may lead to inappropriate or ineffective use of emotional strategies, and the use of maladaptive coping strategies can create internalizing problems in ASD (Rieffe et al., 2011). Additionally, everyday situations often require us to develop coping strategies spontaneously to deal with difficult circumstances; however, those with ASD lacking cognitive flexibility skills may struggle to shift their thoughts from a negative experience to bring adaptive strategies. Burrows et al. (2017) reported that aspects of rumination, defined as passively focusing on negative thoughts in response to a negative experience, are related to cognitive inflexibility, and it was also associated with elevated internalizing problems in ASD. It is no surprise, then, that impairments in EF might directly or indirectly result in internalizing problems in individuals with ASD. Unfortunately, research investigating their EF impairments and co-occurring internalizing problems in ASD children is limited, even though such understanding will be

valuable in providing better evidence-based interventions for the ASD population. Given that there are diagnostic challenges based on mental health assessment alone and internalizing problems can lead to further problems in those with ASD, it is critical to improving the identification and assessment processes for co-occurring symptoms in ASD children.

Association Between Internalizing Problems and Executive Dysfunction

Generally, the current literature review indicated that ASD children and adolescents have deficits in different EF domains, whether using performance-based tasks or behavior rating scales to assess EF (see Table 1). Their significant deficits were particularly notable in cognitive flexibility (i.e., set-shifting ability), inhibition, working memory, and emotional control in the ASD samples (Andersen et al., 2015; Gardiner & Iarocci, 2018; Gotham et al., 2015; Hollocks et al., 2014; Lawson et al., 2015; Lieb & Bohnert, 2017; Vogan et al., 2018). However, there were inconsistent findings regarding inhibition. Although a few studies indicate impairments in inhibition measured by both performance-based tasks (Andersen et al., 2015) and a behavior rating scale (e.g., Gardiner & Iarocci, 2018; Lieb & Bohnert, 2017) in ASD samples, one study indicated that their ASD participants did not have any inhibition deficits using the BRIEF (Lawson et al., 2015). Accordingly, Hill (2004) also reported mixed findings in previous studies that assessed inhibition using performance-based tasks in ASD (Hill, 2004 for review).

Regarding the association between EF impairments and internalizing problems, several studies have indicated that some domains of EF deficits predicted participants' anxiety and depressive symptoms in ASD samples (Andersen et al., 2015; Gardiner & Iarocci, 2018; Gotham et al., 2015; Granader et al., 2014; Hollocks et al., 2014; Lieb & Bohnert, 2017; Vogan et al., 2018). Specifically, the problems with cognitive flexibility (i.e., set-shifting) measured by a performance-based task (e.g., *Card Sorting Task*) and emotional control measured by the BRIEF

Table 1: Studies Included in the Literature Review

Study	*N* [a] with ASD	Age (years)	% Male	Mean IQ (SD)	Comparison groups	Study Designs	Executive Function (EF)			INT problem measure	Did EF predict INT problems (Y/N)
							EF measures	EF domains	EF impaired? (Y/N)		
Andersen et al. (2015)	34	9-16	82%	99.9 (17.4)	TD	Longitudinal Nonexperimental	Color-word (3) Color-word (4) Letter-Number	Inhibition Cognitive Flex. Working memory	Y Y Y	CBCL SMFQ	N (DEP)
Gardiner & Iarocci, (2018)	59	5-13	86%	107.47 (13.25)	TD	Cross-sectional Nonexperimental	BRIEF-P	Inhibit Shift Emotional Control Initiate Working memory Plan/Organize Org. of material Monitor	Y Y Y Y Y Y N Y	BASC-P	N (ANX) Y (DEP)
Gotham et al. (2015)	109	6-24	88%	VIQ56.3 (40.1)	NSDD	Longitudinal Nonexperimental	BRIEF-P	Emotional Control	Y	CBCL DBC-A	Y (ANX) Y (DEP)
Hollocks et al. (2014)	90	14-16	91%	84.5 (17.2)	— [b]	Cross-sectional Nonexperimental	Opposite worlds Trail making Number backward Card Sorting Task	Inhibition Attention-Shifting Verbal WM Set-Shifting	—	PONS	Y (ANX) N (DEP)
Lawson et al. (2015)	70	6-16	90%	107.01 (19.00)	ADHD	Cross-sectional Nonexperimental	BRIEF-P	Inhibit Shift	N Y	CBCL	Y (ANX) Y (DEP)
Lieb & Bohnert (2017)	127	12-17	81%	—	—	Cross-sectional Nonexperimental	BRIEF-P	Inhibition Shift Emotional Control Working Memory	Y Y Y Y	CBCL YSR	Y (DEP)
Vogan et al. (2018)	39	7-14 (T1) 9-16 (T2)	87%	103.3 (14.7)	TD	Longitudinal Nonexperimental	BRIEF-P	BRI MCI	Y N	CBCL	Y (ANX) Y (DEP)

Note. [a] Only the sample and results relevant to this review are reported. [b] This information was not available. INT = Internalizing; CBCL = Child Behavior Checklist – Parent; SMFQ = Short Moods and Feelings Questionnaire; DEP = Depression; ANX = Anxiety; BRIEF-P = Behavior Rating Inventory of Executive Function – Parent Form; BASC-P = Behavior Assessment System for Children – Parent Rating Scale; VIQ = Verbal IQ; NSDD = Non-spectrum Developmentally Delayed; DBC-A = Developmental Behavior Checklist – Anxiety; WM = Working Memory; PONS = Profile of neuropsychiatric symptoms; YSR = Achenbach Youth Self Report; BRI = Behavior Regulation Index (Inhibit, Emotional Control and Shift); MCI = Metacognition Index (Initiate, Organize/Plan, Organization of Materials, Working Memory, and Monitor).

were significantly positively related to greater symptoms of anxiety and depressive symptoms in children with ASD (Gardiner & Iarocci, 2018; Gotham et al., 2015; Hollocks et al., 2014; Lawson et al., 2015). Moreover, these findings were confirmed by a longitudinal study using the BRIEF, and impairments in different EF domains (e.g., shift, inhibit, and emotional control) predicted symptoms of anxiety and depression two years later in children with ASD (Vogan et al., 2018). Thus, some of the ASD symptoms commonly evidenced in everyday situations, such as difficulties in transitioning, and changing focus from one topic to another, seem to be associated with impairments in their EF, which may result in greater internalizing problems. However, a few studies also failed to show an association between EF and internalizing problems, and even though executive dysfunctions were evidenced in ASD samples, it did not predict depressive problems (Andersen et al., 2015; Hollocks et al., 2014) or anxiety problems (Gardiner & Iarocci, 2018). As such, the mechanisms underlying the associations between EF and internalizing problems seem to be still largely unclear.

Problems With Previous Studies

Some of the inconsistent findings could be explained by several different factors. First, research examining the association between EF and internalizing problems utilized a variety of tasks to measure different domains of EF. Specifically, studies investigated inhibition, cognitive flexibility, and working memories in ASD samples using performance-based tasks, such as Opposite Worlds, Test of Everyday Attention for Children (Manley et al., 2001), Trail Making (Reitan, 1958), Number Backwards from the Children's Memory Scale (Cohen, 1997), and Card Sorting task (Grant & Berg, 1948). On the other hand, other studies used EF behavior rating scales to analyze the association between internalizing problems and EF domains. Different EF domains were also investigated in these studies, as some examined the association between

internalizing problems and broader EF indices, while others examined the relationship using the specific EF domains (e.g., inhibition, shift, and emotional control).

Second, a variety of behavior rating scales were utilized to evaluate participants' internalizing problems in different studies. For example, Lawson et al. (2015) and Vogan et al. (2018) used the CBCL to assess both anxiety and depressive problems together as one variable, while Andersen et al. (2015) and Lieb and Bohnert (2017) assessed only depressive problems using the CBCL. In contrast, Gardiner and Iarocci (2018) used the BASC-Parent Form, Gotham et al. (2015) used DBC-A, and Hollocks et al. (2014) used the PONS to assess their participants' internalizing problems. These researchers investigated anxiety and depressive problems as separate variables in their ASD samples.

The third factor explaining inconsistent findings might be the participants' ages in these studies. Previous research showed age-related differences in everyday behavior associated with inhibition and planning, as younger children had more behavior problems associated with inhibition than older children and adolescents, while older children had more problems associated with planning than younger children (van den Bergh et al., 2014). Furthermore, another study documented that younger (i.e., a group consisting of five to seven years old) and older participants with ASD (a group consisting of 14 to 18 years old) had most problems with everyday behavior associated with shift (i.e., cognitive flexibility; Rosenthal et al., 2013). Although Andersen et al. (2015) indicated that the domains of cognitive flexibility and inhibition measured by performance-based neuropsychological assessments improved in ASD at their 2-year follow-up, another study documented deficits in some domains of EF (e.g., working memory, initiation, organization) increased with age in the ASD sample (Rosenthal et al., 2013).

Therefore, including a wide age range of individuals with ASD in a study might have led to conflicting findings.

Lastly, sampling biases were found in most studies investigating EF and internalizing problems in the ASD population. Between 81 to 91% of the participants in the studies reviewed were males in the ASD group when their control groups had an equal or equivalent number of male and female participants. Such gender discrepancies in ASD studies do not even match the CDC estimated male-to-female prevalence ratio of 4.2:1 (Maenner et al., 2021) or a more recently suggested ratio of 3:1 based on a meta-analysis (Loomes et al., 2017). Furthermore, some studies fail to control the significant gender discrepancies in their statistical analyses claiming that gender was not correlated with variables interested in their studies (e.g., Hollocks et al., 2014; Vogan et al., 2018). However, when a significantly small number of female participants are included in an analysis, it would be difficult to detect more subtle differences between genders.

Gender Differences in ASD

Traditionally, it was hypothesized that ASD predominantly affected males. However, there is a trend toward a decreasing male predominance in this disorder, and many researchers claim that females with ASD are under-identified because of methodological issues (e.g., small female samples) and biased ASD criteria and assessments (Hiller et al., 2014; Rivet & Matson, 2011). Therefore, due to the sampling biases in ASD studies, what we know today about ASD seems to apply to largely boys and males with ASD. The gender disparities in autism research must be addressed if we aim to move toward an integrated understanding of the whole autism spectrum in the field. The following section reviews limited studies investigating gender differences in internalizing problems and EFs in ASD children.

Gender Differences in Internalizing Problems

The current literature review suggests that there are no significant gender differences in internalizing problems in ASD children. That being said, the majority of the studies had a lower proportion of females with ASD, and therefore, subtle gender differences might not have been detected (Hull et al., 2017; Rivet & Matson, 2011). Thus far, limited studies have included an equivalent number of ASD participants in each gender, and these studies yielded mixed findings regarding gender differences in internalizing problems in ASD samples. For example, Solomon et al. (2012) and Nasca et al. (2020) used the BASC-2 to examine anxiety and depressive problems in children and adolescents with ASD, and they indicated no significant gender differences in their samples. In contrast, Pisula et al. (2017) used the CBCL to examine gender differences in internalizing problems (anxiety and depressive problems measured together) in ASD adolescents, and they indicated that even though girls with ASD had significantly more internalizing problems compared to TD female samples when they were compared with boys with ASD, the difference was not statistically significant. However, researchers reported that the means of girls with ASD were higher for all the internalizing problems than boys with ASD (Pisula et al., 2017). Hartley and Sikora (2009) also used the CBCL to evaluate internalizing problems in toddlers with ASD, and the findings revealed that girls with ASD had significantly higher internalizing problems (i.e., anxiety and depressive problems measured together) than boys with ASD, though the difference was small.

On the other hand, Mandy et al. (2012) used the SDQ (Goodman et al., 2000) to evaluate children and adolescents' internalizing problems (i.e., emotional problems), and girls with ASD had significantly higher levels of internalizing problems than boys with ASD. Furthermore, when depressive problems were compared as one variable between gender in ASD samples, it was

indicated that adolescent girls with ASD showed significantly higher levels of depressive problems than adolescent boys with ASD or TD adolescents using the RCADS and MASC (Oswald et al., 2016). Nonetheless, the researchers emphasized that the gender differences in depressive problems were observed only during early adolescence, and by late adolescence, levels of depressive problems were similar such that boys with ASD seem to develop more depressive problems later.

Therefore, it is possible that gender differences in internalizing problems may increase as ASD children grow and as they enter adolescent years in ASD samples. For example, Solomon et al. (2012) did not observe any gender differences in anxiety problems when all the ASD participants (ages 8 and 18) were included in their analyses. However, when the researchers examined ASD adolescents alone (ages 12 to 18), more significant anxiety problems were observed, particularly in girls with ASD. Similarly, Gotham et al. (2015) also showed increased levels of internalizing problems of anxiety and depressive problems in adolescent girls with ASD. Gotham et al. (2015) explained that girls with ASD seem to have much faster development in internalizing problems when compared to boys with ASD in adolescents, which created gender differences in their sample. As a result, research tends to suggest that adolescent girls with ASD may be at greater risk for developing internalizing problems than boys with ASD.

Gender Differences in Executive Dysfunction

Depending on which performance-based task was used to examine EF, different results were produced, making it difficult to conclude whether or not any differences exist in the ASD samples. For example, significant gender differences were found in studies using the Trail-Making Test (TMT; Tombaugh, 2004), which measures visuo- and psychomotor speed abilities and cognitive flexibility (Bölte et al., 2011; Lehnhardt et al., 2016). These studies indicated that

females with ASD outperformed males with ASD in the TMT, and females had faster reaction times and better cognitive flexibility than males with ASD. Another study showed gender differences in a stop task (Lemon et al., 2011). The study showed that girls with ASD had significant impairments in inhibitory control compared to TD girls and boys with ASD, as the speed of inhibition was much slower in girls with ASD than in comparison groups.

In contrast, many studies showed little to no gender differences in performance-based tasks, such as the Wisconsin Card Sorting Test (WCST; Heaton et al., 1993) measuring cognitive flexibility (Bölte et al., 2011), the Go/No-Go task (Cragg & Nation, 2008) measuring inhibition (Lai et al., 2012), or the Tower of Hanoi (Goel & Grafman, 1995) measuring working memory and planning (Bölte et al., 2011). However, Memari et al. (2013) examined gender differences in the WCST performance, and unlike the result evidenced in a study by Bölte et al. (2011), this study revealed significant gender differences in their ASD sample, showing that girls with ASD were more impaired in cognitive flexibility than boys with ASD. Lastly, one study used the behavioral rating scale (i.e., the BRIEF) to compare gender differences in everyday EF, and it evidenced that girls with ASD exhibited more problems than boys with ASD, though gender difference was not significant (White et al., 2017). That being said, the study showed that everyday EF problems differed between gender, as girls scored within the clinically significant level (*T*-scores higher than 65) in inhibit, shift, working memory, organization, and monitor scales, while boys scored within the clinically significant level only in shift (White et al., 2017).

Chapter Summary

The literature indicates girls with ASD may have different cognitive processes than boys with ASD, which may explain their unique strengths and weaknesses related to EF. However, a limited number of studies investigated gender differences concerning internalizing problems

(i.e., anxiety and depressive problems) and everyday behavior associated with EF, such that it is not clear if their everyday EF measured by a behavioral rating scale could predict internalizing problems in both genders of ASD. Thus, the purpose of this dissertation study will be twofold: a) to investigate gender differences in internalizing problems and everyday EF among ASD children and adolescents, and b) to examine the association between internalizing problems and everyday EF among ASD children and adolescents. Based on empirical evidence reviewed in this paper, it was hypothesized that girls would present higher levels of internalizing problems than boys. Similarly, it was hypothesized that girls would have greater impairments in everyday EF than boys. Lastly, it was hypothesized that there would be significant associations between internalizing problems and everyday EF in ASD children.

Chapter 3: Methodology

Procedures

This dissertation study used the convenience sampling method to gather secondary neuropsychological assessment data from 60 clinically referred children and adolescents with a primary diagnosis of ASD. De-identified assessment data were originally collected from patients seeking neuropsychological evaluations through the Grant a Gift Autism Foundation Ackerman Center (GGAF) in Alliance with UNLV Health (formerly known as UNLV Medicine Ackerman Center for Autism and Neurodevelopment Solutions) in Nevada. Parents and caregivers of patients consented to use the de-identified assessment data for future research studies as a part of their intake process, and data collection was approved by the University Institutional Review Board (IRB). Licensed psychologists conducted diagnostic evaluations by integrating a thorough assessment of early development, interviews with parents or caregivers, medical and school records review, observation of the child, and performance-based academic and neuropsychological assessment results. Patients were diagnosed with ASD using the diagnostic criteria from the Diagnostic and Statistical Manual of Mental Disorder, 5th edition (DSM-5; American Psychiatric Association, 2013). Autism diagnosis was also further confirmed by the clinicians using the Autism Diagnostic Observation Schedule, Second Edition (ADOS-2; Lord et al., 2012) or the Childhood Autism Rating Scale, 2nd edition (CARS-2; Schopler et al., 2010).

A sample size estimate was calculated to determine the size of the data needed to detect gender differences in internalizing problems in the sample. An effect size of 0.78 for anxiety levels in ASD was obtained using a meta-analysis from van Steensel and Heeman (2017). Using *G*Power* software (3.1.9.6; Faul et al., 2007), it was determined that at least a sample size of 54 would be necessary to detect a significant difference ($\alpha = .05$) between the groups with power (1-

β error probability) of 0.80. Since a larger sample size provides greater power (Suresh & Chandrashekara, 2012), any participants meeting the study criteria were selected from the secondary assessment data for this dissertation study.

Participants

Inclusion criteria for this dissertation study were a) participants with all the necessary assessment results without any missing data (see next section for the measures and assessments), b) school-aged children between five and fifteen years old, c) children with a primary diagnosis of ASD, and d) children with a general conceptual ability (GCA) greater than or equal to 70 measured by a cognitive test [i.e., the Differential Ability Scale-2 (DAS-2); Elliott et al., 2007]. On the other hand, this study excluded children with GCA less than 70 or a clinical diagnosis of intellectual disability (ID) because prior research indicated that these children exhibited a different level and pattern of internalizing problems than ASD children (Brereton et al., 2006; Witwer & Lecavalier, 2010).

A total of 59 participants were selected for the current study since one participant did not meet the study criteria (i.e., the participant's age was out of range for the current study), and thus, it was removed from the data. The data included 44 boys (75%) and 15 girls (25%) between the ages of five and fifteen (M = 8.34). All participants' cognitive ability was assessed by an individually administered battery of cognitive tests (i.e., DAS-2), and their mean IQ (i.e., GCA) was within the average range (M = 90.14, SD = 13.20, range = 70 to 121). The descriptive statistics also indicated that 84.7% of participants were receiving special education services from the school. Descriptive statistics are presented in Table 2.

Table 2: Descriptive Statistics

Measure	Total (N = 59) *M (SD)*	Boys (n = 44) *M (SD)*	Girls (n = 15) *M (SD)*	Stats [a] *t*	*p*
Age	8.34 (2.91)	8.41 (2.69)	8.13 (3.58)	0.27	.788
IQ [b]	90.14 (13.20)	88.93 (13.11)	93.67 (13.25)	-1.20	.243
ASD Severity [c]	46.83 (5.66)	46.82 (5.60)	46.87 (6.03)	-0.27	.978
	Total N (%)	n (%)	n (%)		
Special Education (Y/N)					
IEP [d] ASD	39 (66.1)	30 (68.2)	9 (60.0)		
IEP other categories [e]	11 (18.6)	7 (15.9)	4 (26.7)		
504 plan [f]	3 (5.1)	1 (2.3)	2 (13.3)		
No IEP	6 (10.2)	6 (13.6)	0 (0)		

Note. [a] Independent sample t-tests were conducted. [b] IQ is General Conceptual Ability (GCA) measured by the Differential Ability Scale-2 (DAS-2). [c] Autism severity was measured using the CARS (Childhood Autism Rating Scale, Second Edition), [d] IEP = Children has Individualized Education Program under the eligibility category of autism. [e] other categories were Other Health Impairment, Specific Learning Disability, Developmental Delay, Emotional Disturbance, and Speech or Language Impairment. [f] Students received accommodations through 504 plans from their school.
*$p < .05$, **$p < .01$, ***$p < .001$ (two-sided).

Measures

Cognitive Ability

The General Conceptual Ability (GCA) data were collected to gather information on children's cognitive ability (i.e., IQ) in the study. The Differential Ability Scales, Second Edition (DAS-2) is an individually administered battery of cognitive tests for children two and a half to 17 years of age. Six core subtests yield a GCA score and three subcomponent cluster scores (Verbal Ability, Nonverbal Ability, and Spatial Ability). Verbal Ability is a measure of crystallized intelligence (Gc), Nonverbal Ability is a measure of fluid reasoning (Gc), and Spatial Ability is a measure of visual-spatial abilities (Gv; Elliot, 2007). Raw scores are converted into standard scores (a mean of 100 and a standardized deviation of 15), and higher standard scores indicate better cognitive ability. For this current study, the GCA was of interest.

The DAS-2 is reported to have high internal consistency reliability, test-retest reliability, and specificity with satisfactory construct, convergent, discriminant, and concurrent validity, showing that the test is related to an establishing criterion assessment (Elliott et al., 2007).

Internalizing Problems

Internalizing problems of anxiety and depressive problems were assessed using the Child Behavior Checklist (CBCL; Achenbach & Ruffle, 2000). The CBCL is a parent rating scale that screens for emotional and behavioral problems in children between 1.5 and 18 years old in the last six months. The questionnaire consists of 113 items that are answered on a 3-item Likert-type scale response format that yields eight syndrome scales (*Anxious/Depressed, Withdrawn/Depressed, Somatic Complaints, Social Problems, Thought Problems, Attention Problems, Rule-Breaking Behavior,* and *Aggressive Behavior*), six DSM-Oriented scales (*Depressive Problems, Anxiety Problems, Semantic Problems, Attention-Deficit/Hyperactivity Problems, Oppositional Defiant Problems,* and *Conduct Problems*), and three broader band scales (*Internalizing Problem, Externalizing Problem,* and *Total Problem*). The syndrome scales are empirically based, as it is statistically generated based on scores obtained from CBCL, while the DSM-Oriented scale corresponds to emotional problems in the DSM diagnostic category (Achenbach & Ruffle, 2000). Raw scores are converted into standardized *T* scores, and these scores can be reported in the normal limits range (*T* scores of 50-64), borderline clinical range (*T* scores of 65-69), and the clinical range (*T* scores of above 70).

The DSM-Oriented scales of *Depressive Problems* and *Anxiety Problems* were shown to identify the presence of depression and anxiety in the ASD sample (Magyar & Pandofli, 2017), and these measures were of interest in the current study, given the purpose of this research is to evaluate anxiety and depressive problems in ASD. The CBCL is reported to have adequate

reliability (e.g., test-retest reliability of .89, inter-parent reliability ranged between .65 and .75) and validity (e.g., construct validity ranged between .46 and .93) in the ASD population, and that the CBCL is able to discriminate ASD children from a typically developing control group (Mazefsky et al., 2011).

Everyday Behavior Associated With Executive Function

Everyday behavior associated with EF (i.e., everyday EF) was evaluated using the Behavior Rating Inventory of Executive Functions, Second Edition (BRIEF-2) Parent Form (Gioia et al., 2015). The BRIEF-2 Parent Form is a questionnaire consisting of 63 items completed by parents of school-aged children, five through 18 years of age. Each item is scored on a 3-item Likert scale. The BRIEF-2 measures everyday EF in eight subdomains: inhibition, shift, emotional control, initiation, working memory, planning and organization, organization of materials, and self-monitoring. In addition, there are three higher-order indices with an overall composite score: Behavior Regulation Index (BRI), Emotion Regulation Index (ERI), Metacognition Index (MI), and Global Executive Composite (GEC). BRI is obtained by summing the raw scores for inhibit and self-monitor, and the raw score for BRI is then converted into a standardized *T* score. ERI is calculated by adding the raw scores for shift and emotional control, then converted into a standardized *T* score. MI is obtained by adding the raw scores for the initiate, working memory, plan/organize, task-monitor, and organization of materials to obtain a standardized *T* score. Lastly, GEC is obtained by adding the raw scores from BRI, ERI, and CRI, and the total raw score is converted into a GEC *T* score. All the *T* scores are used to interpret the level of executive functioning as reported by parents on the forms. *T* scores of 60 to 64 are considered mildly elevated, 65 to 69 are considered potentially clinically elevated, and above 70 are considered clinically elevated.

BRI and ERI were of interest in this current study. Prior studies indicated BRI, which includes inhibit and self-monitor, predicted symptoms of anxiety and depression in ASD (Gardiner & Iarocci, 2018; Vogan et al., 2018). Other studies also evidenced that shift and emotional control subdomains were related to anxiety and depression in ASD (Gardiner & Iarocci, 2018; Lawson et al., 2015), and ERI includes these subdomains. The BRIEF-2 is reported to have high internal consistency (ranging from .76 to .96), high test-retest reliability (ranging from .61 to .92), and moderate interrater correlations between parent and teacher forms (ranging from .24 to .49) within the clinical sample (Gioia et al., 2015). Additionally, the BRIEF has good content, convergent, and divergent validity, and the BRIEF is evidenced to have high associations with other similar behavioral measures of EFs (Gioia et al., 2015).

Autism Severity

Autism spectrum symptoms were collected using the Childhood Autism Rating Scale, Second Edition (CARS-2; Schopler et al., 2010). The CARS-2 is a rating scale for children on a 4-point Likert rating scale (e.g., 1 = typical development, 2 = mildly abnormal/atypical behavior or responses, 3 = moderately abnormal/atypical behavior or responses, 4 = severely abnormal/atypical behavior or responses). The CARS-2 consists of 15 items, and it is rated by a trained clinician based on observations, parent reports, and relevant medical records. Total raw scores are classified into three severity groups; raw scores of below 28 indicate minimal-to-no symptoms of autism spectrum disorder, scores of 28 to 33.5 indicate mild-to-moderate symptoms of autism spectrum disorder, and scores of 34 and higher indicate severe symptoms of autism spectrum disorder. Furthermore, the total raw score can be converted into a *T*-score based on a clinical sample of those with ASD, and higher *T* scores indicate more severe symptoms of autism. The *T* score may be used to "reflect a continuum of the behavioral problems that are

related to autism and are useful when the goal of a clinician or researcher is to make comparative judgments regarding the level of autism-related behaviors present in a given individual or group" (p. 3, Schopler et al., 2010). As such, *T* scores in the CARS were used to assess the severity of autism problems in the participants. The CARS is recognized as one of the most empirically validated instruments with high criterion-related validity, interrater and test-retest reliability, and internal consistency (Mayes et al., 2009; Schopler et al., 2010).

Data Analysis

Data analyses were conducted using IBM SPSS Statistics, version 28. Each participant was provided dichotomous values to indicate their gender (Male = 0, Female = 1). Statistically significant results were reported at $p < .05$, $p < .01$, and $p < .001$ levels. For this dissertation study, a *p*-value less than .05 was considered significant.

Data Inspection

Prior to the primary multivariate analysis of covariance (MANCOVA) of gender differences in internalizing problems and everyday EF, a series of diagnostic tests were performed to examine the assumption of multivariate normality. First, a linear relationship between dependent variables and independent variable, as well as dependent variables and covariates, were assessed by inspecting scatterplot matrices per gender. Then, to ensure no outlier in the data, all dependent variable scores (internalizing problems and everyday EF) were examined using boxplots to detect any significant univariate outlier, and no outlier was detected. Additionally, Cook's Distance Statistics (Cook's D) was performed to assess the degree of influence of each participant's observations on the model. The threshold value =1 was used, as suggested by Parke (2013), and none of Cook's D values exceeded the threshold. Multivariate outliers in the data were also inspected using Mahalanobis Distance. To detect any significant

values, the chi-square distribution was calculated for the degree of freedom. The results showed that no case had significant values (i.e., they were $p > .01$), indicating unusual combinations of scores were not present in the data.

Next, the distribution of the variables was explored by checking q-q plots first. Then, to underpin the graphical inspection of normality, the values of skewness and kurtosis were converted to standardized z-scores, which were compared against the values for the normal distribution at $p < .05$ based on the recommendation from Field (2017). For both groups, z-scores for skewness and kurtosis fell within the normal distribution values, and therefore, it was assumed that the distributions of variables were normally distributed. Furthermore, the variables were evaluated for the assumption of homogeneity of variances using Levene's test. The test resulted in non-significant ($p > .05$) using mean or median scores, and thus, the variances were assumed to be similar between groups for the present data.

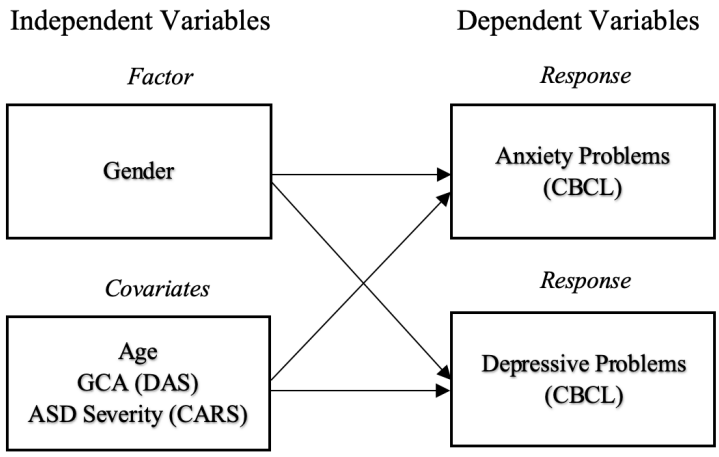
In addition, the homogeneity of variance and covariances was inspected to ensure that the observed covariance matrices for dependent variables (internalizing problems and everyday EF) were roughly equal across groups. Box's Test of Equality of Covariance Matrices resulted in non-significant ($p > .05$), suggesting that variance-covariance matrices across groups were similar. The homogeneity of regression slopes was also inspected to ensure that the relationships between dependent variables and covariates were roughly the same across groups. Specifically, the relationships between gender and age, gender and IQ, and gender and ASD severity were examined for internalizing problems and everyday EF separately as dependent variables. Since these procedures all resulted in non-significant ($p > .05$), the relationships between the dependent variables and covariates were assumed to be roughly the same across groups, such that no violations were found in the present data. Also, the characteristics of participants between groups

were examined to ensure similar distribution of dependent variables and covariates using independent samples *t*-tests. Finally, the correlations among dependent variables were conducted using Pearson correlation analysis to examine associations between variables of interest.

Research Question 1

A one-way multivariate analysis of covariance variance (MANCOVA) was performed to examine if boys and girls with ASD differed in their levels of internalizing problems (i.e., anxiety and depressive problems). The analysis compared *T* scores of anxiety problems and depressive problems obtained by the CBCL across gender. As a result, the variables of interest in this analysis were gender, age, cognitive ability, ASD severity, and internalizing problems (anxiety and depressive problems). Figure 2 illustrates the relations between the variables.

Figure 2: Path Representation of the MANCOVA: Internalizing Problems as Dependent Variables



Note. GCA = General Conceptual Ability, DAS = Differential Ability Scales, CARS = Childhood Autism Rating Scale, CBCL = Child Behavior Checklist.

Independent Variable. Gender was an independent variable (i.e., factor) for the analysis. Each gender was dummy coded, and all boys in the data were given zero (Male = 0), while all girls were given one (Female = 1).

Dependent Variables. Internalizing problems measured by the CBCL were dependent variables to answer the first research question. In the analysis, *T* scores of *Anxiety Problems* and *Depressive Problems* from the CBCL were used to measure levels of internalizing problems. Higher *T* scores indicate more significant internalizing problems.

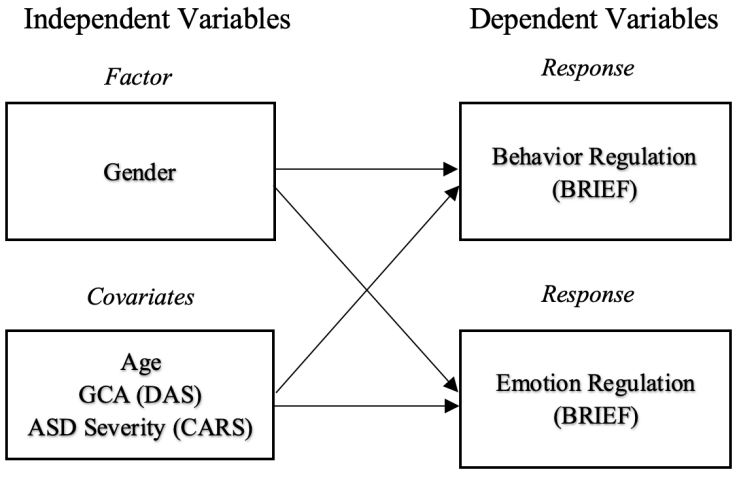
Covariates. In the analysis, age, cognitive ability, and ASD severity were covariates. Research evidenced that higher levels of anxiety and depression were reported in older participants with ASD in previous studies (e.g., Gotham et al., 2015; Maskey et al., 2013; Mayes et al., 2011a; van Steensel et al., 2011; van Steensel & Heeman, 2017). In addition, higher cognitive ability (i.e., IQ) was found to have positive associations with increased levels of anxiety (e.g., Gotham et al., 2015; Kim et al., 2000; Kushki et al., 2013; Mayes et al., 2011; Mazurek & Kanne, 2010; Salazar et al., 2015; Sukhodolsky et al., 2008; Wijnhoven et al., 2018) and depression (Hudson et al., 2019; Mayes, Calhoun, Murray, Morrow, et al., 2011; Vickerstaff et al., 2007) in ASD samples. Lastly, prior studies have indicated that the severity of autism symptoms was positively associated with internalizing problems in ASD children (Andersen et al., 2015; Eussen et al., 2013; Kanne et al., 2011; MacNeil et al., 2009; Maskey et al., 2013; Mayes et al., 2011; Mazurek & Kanne, 2010; van Steensel et al., 2011; Wood & Gadow, 2010). Since this research question attempted to examine the gender differences in internalizing problems after eliminating the previously shown variables to influence internalizing problems (i.e., confounds), three covariates (age, cognitive ability, ASD severity) were applied to the analysis to improve the model.

Hypothesis 1. Gender differences in internalizing problems would exist, such that girls with ASD would have higher levels of anxiety and depressive problems than boys with ASD. Prior research using the CBCL to measure internalizing problems indicated that girls with ASD showed higher levels of all measures of internalizing problems than boys with ASD (e.g., Mandy et al., 2012; Pisula et al., 2017).

Research Question 2

A one-way MANCOVA was performed to examine if boys and girls with ASD differed in their levels of problems with everyday EF (i.e., behavior and emotion regulation). The analysis compared *T* scores of the Behavior Regulation Index (BRI) and Emotional Regulation Index (ERI) obtained by the BRIEF between gender. Thus, the variables of interest in this analysis were gender, age, cognitive ability, and everyday EF (behavior and emotion regulation). Figure 3 illustrates the relations between the variables.

Figure 3: Path Representation of the MANCOVA: Everyday Executive Functions as Dependent Variables



Note. GCA = General Conceptual Ability; DAS = Differential Ability Scales; BRIEF = Behavior Rating Inventory of Executive Functions.

Independent Variable. Gender was an independent variable (i.e., factor) for the analysis. Each gender was dummy coded for this analysis, and all boys in the data were assigned zero (Male = 0) while all girls were assigned one (Female = 1).

Dependent Variables. To answer the second research question, everyday EF measured by the BRIEF were dependent variables for the analysis. *T* scores of behavior regulation index (BRI) and emotion regulation index (ERI) obtained from the BRIEF were of interest for the analysis. Higher *T* scores from the BRIEF indicate more significant behavior and emotion regulation problems.

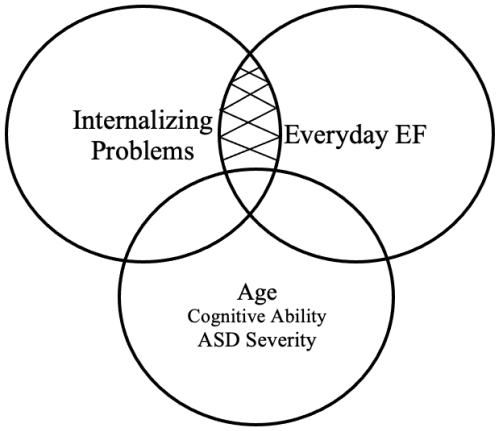
Covariates. Age, cognitive ability, and ASD severity were covariates for the analysis. Prior studies using the BRIEF in the ASD population showed significant age effects on inhibition (van den Bergh et al., 2014) and shift (Rosenthal et al., 2013). Other studies revealed complicated relations between IQ and BRIEF scales in the ASD population. For example, one study showed a negative association between IQ and overall everyday EF skills (Kalbfleisch & Loughan, 2012), while another study showed no correlation between IQ and any BRIEF scales (Blijd-Hoogewys et al., 2014). Lastly, Hiller et al. (2014) and other researchers (e.g., Jiujias et al., 2017; LeMonda et al., 2012) argue that some ASD-related symptoms might be explained by their executive dysfunction. Since this research question attempted to investigate gender differences in everyday EF after eliminating these variables that were previously shown to influence the outcome, covariates were included to improve the model.

Hypothesis 2. Gender differences in everyday EF would exist, and girls with ASD would have higher levels of problems in both behavior regulation and emotion regulation than boys with ASD. A prior study using the BRIEF showed that girls with ASD exhibited more overall problems with everyday behaviors associated with EF than boys with ASD (White et al., 2017).

Research Question 3

Two separate multiple linear regression analyses were computed to obtain third-order partial correlations of the association between everyday EF (i.e., BRI and ERI) and internalizing problems (anxiety and depressive problems) after removing the influence of age, cognitive ability, and ASD severity. The specific analyses removed (i.e., partial out) the influence of covariates on dependent variables from the correlations to examine the association between dependent variables without confounding factors. As a result, the variables of interest in the analyses were internalizing problems (anxiety and depressive problems), everyday EF (behavior and emotion regulation), age, cognitive ability, and ASD severity. Figure 4 illustrates the relations between the variables.

Figure 4: Partial Correlation Between Internalizing Problem and Everyday Executive Functions Controlling for Age, Cognitive Ability, and ASD Severity



Note. The shaded area represents variance shared by internalizing problems and everyday EF not influenced by age, cognitive ability, and ASD severity.

Predictor Variables. To answer the third research question, everyday EF measured by the BRIEF were predictor variables for the analyses. *T* scores of behavior regulation index (BRI) and emotion regulation index (ERI) obtained from the BRIEF were of interest for the analyses. Higher *T* scores from the BRIEF indicate more significant behavior and emotion regulation problems.

Dependent Variables. To answer the third research question, internalizing problems measured by the CBCL were dependent variables. *T* scores of anxiety problems and depressive problems in the DSM-Oriented scales from the CBCL were interests for the analyses. Higher *T* scores from the CBCL indicate more significant internalizing problems.

Covariates. Age, cognitive ability, and ASD severity were covariates to compute the partial correlations in the question. Prior studies indicated that age had associations with both internalizing problems (Gotham et al., 2015; Maskey et al., 2013; Mayes et al., 2011; van Steensel et al., 2011; van Steensel & Heeman, 2017) and everyday EF measured by the BRIEF in the ASD population (Rosenthal et al., 2013; van den Bergh et al., 2014). Additionally, previous studies indicated that cognitive ability (i.e., IQ) and internalizing problems (e.g., Gotham et al., 2015; Hudson et al., 2019; Kushki et al., 2013; Mayes et al., 2011; Mazurek & Kanne, 2010; Salazar et al., 2015; Wijnhoven et al., 2018), as well as cognitive ability and EF measured by the BRIEF (e.g., Blijd-Hoogewys et al., 2014; Kalbfleisch & Loughan, 2012), were associated in the ASD population. Lastly, several studies showed that ASD severity was associated with both internalizing problems (Andersen et al., 2015; Eussen et al., 2013; Kanne et al., 2011; Maskey et al., 2013; Mayes et al., 2011; Mazurek & Kanne, 2010; van Steensel et al., 2011; Wood & Gadow, 2010) and executive dysfunction (Hiller et al., 2014; Jiujias et al., 2017; LeMonda et al., 2012).

Hypothesis 3-1. It was hypothesized that there would be no significant positive correlation between behavior regulation challenges and anxiety problems after removing the effects of age, cognitive ability, and ASD severity in ASD children. The previous study evidenced mixed findings, and one study indicated that BRI was associated with the *Anxiety/Depression* scale measured by the CBCL (Vogan et al., 2018); however, other studies measuring anxiety and depressive symptoms did not show any association with BRI and anxiety symptoms in the ASD population (e.g., Gardner & Iarocci, 2018; Wallace et al., 2016).

Hypothesis 3-2. It was hypothesized that there would be a positive correlation between behavior regulation challenges and depressive problems after removing the effects of age, cognitive ability, and ASD severity in ASD children. Gardner and Iarocci (2018) indicated that the BRI measured by the BRIEF was a significant predictor of depressive problems measured by the BASC in their ASD sample.

Hypothesis 3-3. It was hypothesized that there would be a positive correlation between emotion regulation challenges and anxiety problems after removing the effects of age, cognitive ability, and ASD severity in ASD children. No prior study thus far has explicitly investigated the associations between ERI and anxiety problems in the ASD population using the BRIE-2; however, a few studies evidenced that anxiety was associated with more impaired shift (Lawson et al., 2015) and emotional control (Gotham et al., 2015) as measured by the BRIEF, and these clinical scales together form the emotion regulation index (ERI).

Hypothesis 3-4. It was hypothesized that there would be a positive correlation between emotion regulation challenges and depressive problems after removing the effects of age, cognitive ability, and ASD severity in ASD children. No prior study has specifically investigated the associations between ERI and depression in the ASD population using the BRIEF-2;

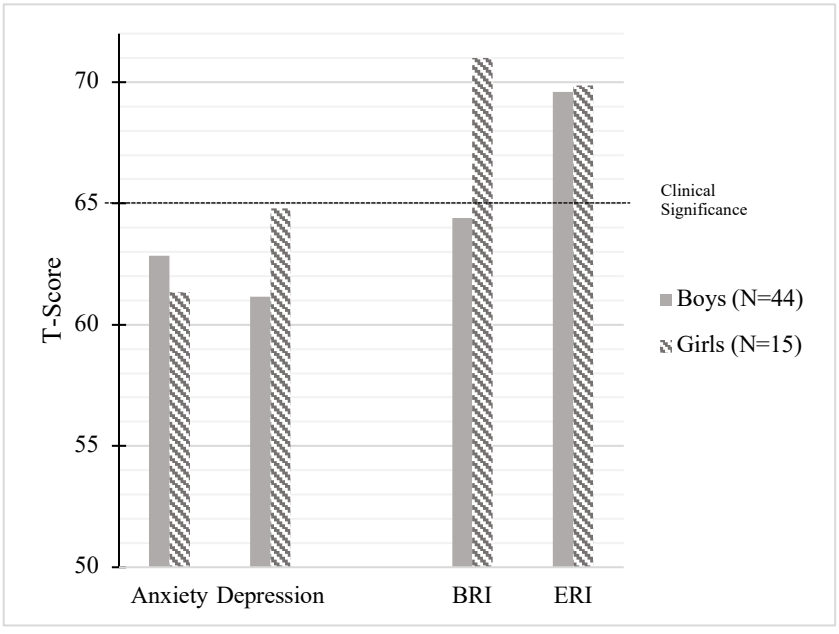
however, some prior studies evidenced that depression was associated with more impairment in shift (Lawson et al., 2015), emotional control (Gotham et al., 2015), or both (Gardiner & Iarocci, 2018; Lieb & Bohnert, 2017).

Chapter 4: Results

Descriptive Analysis

The study included 44 boys and 15 girls with ASD, maintaining an estimated male-to-female prevalence ratio of 3:1 suggested by Loomes et al. (2017). Independent-sample *t*-tests indicated that age of participants [$t(19.651) = .273$, $p = .788$], IQ scores [$t(24.033) = –1.198$, $p = .243$], or ASD severity [$t(22.803) = –.027$, $p = .978$] were not significantly different between gender. In the study sample, more boys with ASD had IEP under the eligibility category of ASD (68%) than girls with ASD (60%). In contrast, more girls with ASD had IEP under other eligibility categories (e.g., other health impairment, specific learning disability, speech and language impairment) than boys with ASD. Nonetheless, more boys with ASD (13.6%) did not receive any special education services compared to girls (0%) in this sample.

Figure 5: Scores on the CBCL and BRIEF-2 for Boys and Girls with ASD



Note. T score ≤ 65 is considered a clinically significant level.

In addition, Pearson correlation coefficients were computed to examine correlations among the dependent variables and covariates. The results of these correlational analyses showed that all four dependent variables were significantly positively correlated with each other (see Table 3). Depressive problems and anxiety problems were moderately correlated ($r = .654$, $p < .001$), and depressive problems were also moderately correlated with BRI ($r = .567$, $p < .001$) and ERI ($r = .542$, $p < .001$). On the other hand, anxiety problems were weakly correlated with BRI ($r = .335$, $p = .010$) and ERI ($r = .372$, $p = .004$). BRI and ERI were strongly correlated ($r = .812$, $p < .001$). Lastly, participants' age was weakly positively correlated with ASD severity ($r = .334$, $p = .010$), and as the participants' age went up, so as the ASD severity.

Finally, 43.4% ($n = 26$) of participants in this study were reportedly experiencing within the clinical range (T score ≥ 65) of anxiety or depressive problems [43.4% ($n = 26$)]. Moreover, astonishingly high numbers of participants were reportedly experiencing challenges related to everyday EF, as 59% ($n = 35$) and 73% ($n = 43$) of them were experiencing within the clinical range of behavior regulation and emotion regulation problems, respectively (see Figure 5).

Table 3: Pearson Correlations Coefficient

	1	2	3	4	5	6	7
1. Age	–						
2. IQ [a]	-.09	–					
3. ASD Severity	.33**	-.13	–				
4. Anxiety Problems	.22	.11	.04	–			
5. Depressive Problems	.07	.03	.08	.65***	–		
6. Behavior Regulation (BRI)	-.03	-.11	.01	.34**	.57***	–	
7. Emotion Regulation (ERI)	.04	-.14	.11	.37**	.54***	.81***	–

Note. [a] General Conceptual Ability (GCA). BRI = Behavior Regulation Index. ERI = Emotion Regulation Index.
*$p < .05$, **$p < .01$, ***$p < .001$ (two-tailed)

Research Question 1: One-Way MANCOVA

A one-way multivariate analysis of covariance was performed on two dependent variables (anxiety and depressive problems) after controlling for age, cognitive ability, and ASD severity scores to examine if boys and girls with ASD differed in their levels of internalizing problems. The independent variable for the analysis was gender (boy and girl). Assumptions of normality [$Z_{skewness} > |1.96|$ and $Z_{kurtosis} > |2.58|$ for anxiety and depressive problems], homogeneity of variance [Levene's test; $F(1, 57) = .03$, $p = .857$ for anxiety problems, $F(1, 57) = .026$, $p = .873$ for depressive problems], homogeneity of variance-covariance matrices [Box's M = 1.43, $F(3, 11041) = .45$, $p = .717$], linearity, and multicollinearity (Tolerance = .34, VIF = 2.94) were satisfactory. The analysis revealed that combined internalizing problems (anxiety and depressive problems) were not statistically significantly different between gender with the use of Wilks' criterion [$\Lambda = .90$, $F(2,53) = 2.91$, $p = .063$, partial $\eta^2 = .10$]. Accordingly, univariate tests also confirmed that there was a non-significant difference between gender in terms of anxiety [$F(1, 54) = .31$, $p = .580$, partial $\eta^2 = .01$] or depressive problems [$F(1, 54) = 1.79$, $p = .186$, partial $\eta^2 = .03$]. Thus, anxiety or depressive problems together or by themselves had no significant difference between gender (see Table 4).

Table 4: Summary of MANCOVA Examining the Effect of Gender on Internalizing Problems and Everyday EF Controlling for the Effect of Age, IQ, and ASD Severity

	Depressive Problems					Anxiety Problems				
Source	*Type III SS*	*df*	*MS*	*F*	Partial η^2	*Type III SS*	*df*	*MS*	*F*	Partial η^2
Main Effect										
Gender	145.29	1	145.29	1.79	.03	35.90	1	35.90	0.31	.01
Covariates										
Age	14.27	1	14.27	0.18	.00	330.06	1	330.06	2.85	.05
IQ [a]	0.48	1	0.48	0.01	.00	130.61	1	130.61	1.13	.02
ASD [b]	12.53	1	12.53	0.15	.00	2.52	1	2.52	0.02	.00
	Behavior Regulation					Emotion Regulation				
Source	*Type III SS*	*df*	*MS*	*F*	Partial η^2	*Type III SS*	*df*	*MS*	*F*	Partial η^2
Main Effect										
Gender	555.82	1	555.82	5.13	.09**	6.30	1	6.30	0.05	.00
Covariates										
Age	7.69	1	7.69	0.07	.00	0.22	1	0.22	0.00	.00
IQ	150.86	1	150.86	1.39	.03	117.81	1	117.81	0.96	.02
ASD	0.12	1	0.12	0.00	.00	57.18	1	57.18	0.47	.01

Note. [a] General Conceptual Ability (GCA) was obtained for IQ, [b] ASD severity
*p <.05, **p < .01, ***p < .001

Research Question 2: One-Way MANCOVA

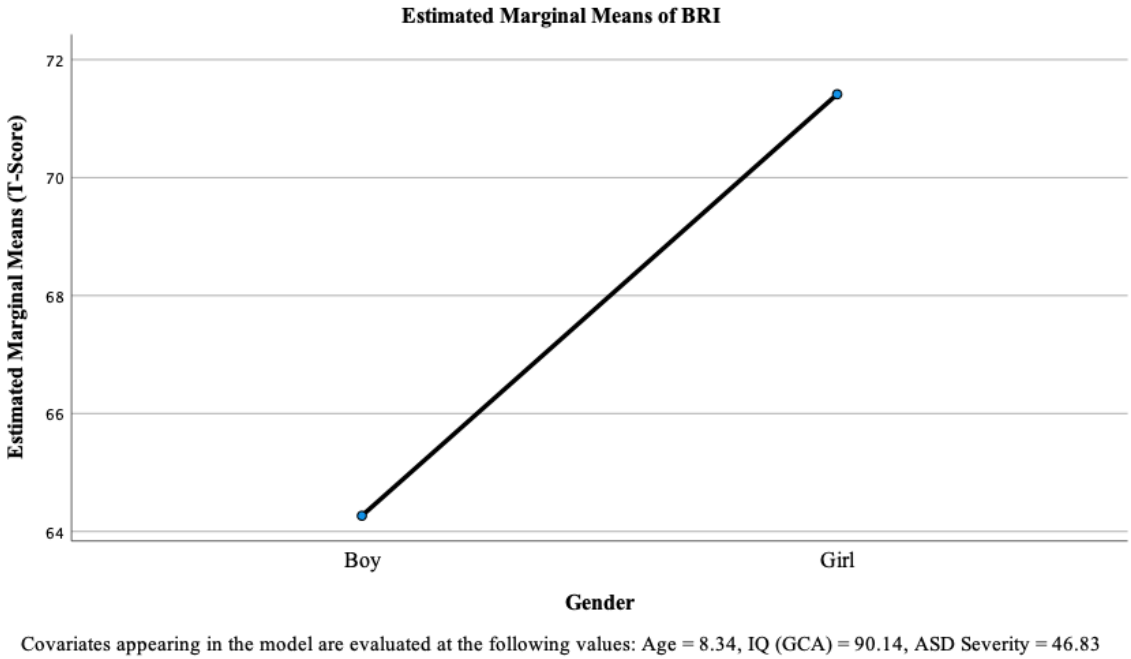
A one-way multivariate analysis of covariance was performed on two dependent variables, behavior regulation index (BRI) and emotion regulation index (ERI), after controlling for age, IQ, and ASD severity scores to examine if boys and girls with ASD differed in their levels of problems with everyday EF. The independent variable for the analysis was gender (boy and girl). Assumptions of normality [$Z_{skewness} > |1.96|$ and $Z_{kurtosis} > |2.58|$ for BRI and ERI], homogeneity of variance [Levene's test; $F(1, 57) = 2.29$, $p = .136$ for BRI; $F(1, 57) = 3.49$, $p = .067$ for ERI], homogeneity of variance-covariance matrices [Box's M = 3.46, $F(3, 11041) = 1.09$, $p = .352$], linearity, and multicollinearity (Tolerance = .34, VIF = 2.94) were satisfactory. The analysis revealed that combined behavior and emotion regulation were statistically significantly different between gender with the use of Wilks' criterion [$\Lambda = .28$, $F(2,53) = 7.32$, p

= .002, partial η^2 = .22]. Furthermore, separate univariate tests on the outcome variables revealed a significant difference in behavior regulation using an alpha level of .05 [$F(1, 54)$ = 5.13, p = .028, partial η^2 = .09], but not in emotion regulation [$F(1, 54)$ = .05, p = .822, partial η^2 = .00]. Similarly, post-hoc analyses with Bonferroni-adjusted pairwise comparisons revealed that the mean score of BRI in girls with ASD was statistically significantly higher than in boys with ASD [7.15, (95% CI, .821 to 13.47), $p < .05$], but there was no significant difference of the mean score of ERI between gender [.76, (95% CI, -.598 to 7.50), p = .82; see Table 5]. As a result, the analyses evidenced that problems with behavior regulation were significantly different between genders, and BRI scores were significantly higher in girls than boys with ASD (see Figure 6).

Table 5: Observed Group Means with Standard Deviations and Group Mean Adjusted for Covariates with Standard Errors for Dependent Variables

	Male (N = 44)				Female (N = 15)			
	Observed		Adjusted		Observed		Adjusted	
Variable	*M*	*SD*	*M*	SE	*M*	*SD*	M	SE
Depressive Problems	61.16	8.77	61.16	1.36	64.80	8.92	64.81	2.35
Anxiety Problems	62.84	10.91	62.92	1.63	61.33	10.68	61.10	2.81
Behavior Regulation	64.41	9.59	64.27	1.58	71.00	12.11	71.41	2.72
Emotion Regulation	69.61	9.96	69.49	1.68	69.87	13.59	70.25	2.89

Figure 6: Plots Showing Comparison Between Gender in Adjusted Mean Score on BRI



Research Question 3: Third-Order Partial Correlation

Two separate multiple linear regression analyses were computed to obtain a partial correlation between everyday EF (BRI and ERI) and internalizing problems (anxiety and depressive problems), controlling for age, cognitive ability (IQ), and ASD severity. The results indicated that all four variables were positively correlated (see Table 6). Specifically, when age, cognitive ability, and ASD severity were controlled for the association between BRI and anxiety problems, the following partial correlation was found $r = .08$, $p = .556$. When age, cognitive ability, and ASD severity were controlled for the association between BRI and depressive problems, the following partial correlation was found $r = .27$, $p < .05$. In addition, when age, cognitive ability, and ASD severity were controlled for the association between ERI and anxiety problems, the following partial correlation was found $r = .19$, $p = .171$. Finally, when age,

cognitive ability, and ASD severity were controlled for the association between ERI and depressive problems, the following partial correlation was found $r = .17$, $p = .229$. As a result, the analyses showed that overall, internalizing problems and everyday EF had none to negotiable associations, after removing the effect of age, cognitive ability, and ASD severity, except for the association between behavior regulation and depressive problems, which had a weak positive association.

Table 6: Partial Correlation (*r*) of Everyday EF and Internalizing Problems Controlling for Age, IQ, and ASD Severity

Variable	*r* (BRI [a] partialed out)	*r* (ERI [b] partialed out)
Anxiety Problems	.081	.187
Depressive Problems	.270*	.165

Note. N = 59, [a] Behavior Regulation Index from the BRIEF, [b] Emotion Regulation Index from the BRIEF
*$p < .05$, **$p < .01$, ***$p < .001$ (two-tailed).

Chapter 5: Discussion

The present study investigated gender differences in internalizing problems and everyday behavior associated with everyday EF in ASD children, and also if these variables were associated. According to a few studies examining gender differences in ASD samples, it was indicated that there could be different presentations of ASD-related symptoms between genders (Gotham et al., 2015; Hiller et al., 2016; Lemon et al., 2011; Lieb & Bohnert, 2017; Sedgewick et al., 2016; Solomon et al., 2012; White et al., 2017). However, females with ASD are under-studied in ASD research (Begeer et al., 2013; Rivet & Matson, 2011), and therefore, what we know today about ASD applies primarily to males with ASD. Moreover, several ASD children suffer from co-occurring internalizing problems due to their social challenges and other ASD-related symptoms. Thus, it is critical to gain an in-depth understanding of ASD-related symptoms in *all* ASD children and of the risk factors associated with their symptoms, in order to provide appropriate services and interventions.

Gender Differences in Internalizing Problems

The present study investigated and answered three research questions. The first research question examined gender differences in internalizing problems in children and adolescents with ASD. Contrary to the hypothesis, the study did not find significant gender differences in anxiety or depressive problems. That being said, the mean score of depressive problems in girls with ASD was higher than in boys with ASD, though the difference was small. Other previous studies also indicated similar findings: a higher mean score of internalizing problems was found in girls with ASD, but the gender difference did not reach a statistically significant level (Hartley & Sikora, 2009; Pisula et al., 2017). Even though the present study maintained a suggested ASD

gender ratio of 3:1, it still entailed a relatively small clinical sample of girls with ASD. Therefore, increasing the sample size might have resulted in a different outcome.

Another possible reason for not finding gender differences in internalizing problems in the present study could be that the study did not include many ASD adolescents, as almost 70% of participants were children under the age of nine (68% for boys, 73% for girls). A prior study with a mean age of 15 years showed a significant gender difference in depression, and the authors hypothesized that early adolescent girls with ASD might have higher levels of depression than boys with ASD (Oswald et al., 2016). Similarly, other studies showed that gender differences in internalizing problems were found only in ASD adolescents (Gotham et al., 2015; Solomon et al., 2012), and it was hypothesized that girls with ASD might have a sudden increase in internalizing problems during adolescence years (Gotham et al., 2015), leading to significant gender differences. Therefore, the lack of ASD adolescents in this study might have contributed to the lack of significant gender differences in internalizing problems in the sample. Future studies may examine gender differences in internalizing problems among different age groups. Also, longitudinal studies will be necessary to understand if different levels of internalizing problems exist among different age groups.

Nonetheless, regardless of gender, almost half of the participants in the study reportedly experienced elevated levels of anxiety and depressive problems. This finding is consistent with prior research, indicating a high prevalence of anxiety and depression in ASD children and adolescents (e.g., van Steensel et al., 2011). The high incidence of internalizing problems in the ASD population is a matter of concern, as their problems could contribute to more social communication challenges over time (Duvekot et al., 2018). Moreover, anxiety problems are likely to exacerbate autism symptoms due to a range of secondary behavioral and emotional

problems, which could also lead to academic and social difficulties in ASD students (White et al., 2014). Thus, the present study highlights the importance of identifying ASD children with internalizing problems as soon as possible, in order to provide the support and interventions that they need.

Gender Differences in Everyday Executive Functions

The second research question examined gender differences in everyday EF, and the present study found a significant gender difference in levels of problems in everyday EF. Specifically, girls with ASD had significantly more behavior regulation problems than boys with ASD, consistent with the hypothesis. This finding is similar to previous research indicating more significant EF problems in girls with ASD in Behavior Regulation Index (BRI; White et al., 2017) and a subscale within BRI (that is, inhibition) measured by a performance-based task (e.g., Lemon et al., 2011; Memari et al., 2013). Thus, this study supports the notion that there may be gender differences in ASD-related symptoms in the ASD population, and girls with ASD may struggle more in some areas of EF than boys with ASD. Unfortunately, it has been reported that girls with ASD do not receive the same care that boys with ASD receive in school settings. For example, researchers reveal that teachers often fail to notice developmental and behavioral problems in girls with ASD (Hiller et al., 2016; Mandy et al., 2012). Further, girls with ASD tend to receive significantly less support and services from teachers compared to boys with ASD, in the general education classrooms (May et al., 2014).

One of the theories describing the under-identification of challenges in girls with ASD is the camouflaging hypothesis, which suggests that more girls with ASD than boys with ASD engage in "camouflaging strategies" to conceal their ASD-related challenges (Hull, Petrides, et al., 2020). Camouflaging is not a new concept, and this phenomenon has been recognized for a

while, as it has been found not only in the ASD population but also in neurotypical individuals (e.g., Hull, Lai, et al., 2020; Jorgenson et al., 2020) and individuals with depression (Fombonne, 2020). Camouflaging has gained much popularity in recent years, to explain some of the reasons for misdiagnoses or underdiagnoses in girls and females with ASD. Camouflaging is defined as concealing, hiding, or controlling behaviors associated with autism. Hull, Petrides, et al. (2017) find that the goal of camouflaging is "simply not having overt functional impairments or raising concerns of teachers or other professionals" (p. 2521). Other reasons for camouflaging in ASD are reported as follows: masking and compensation to try to fit in because of the stigma against ASD (Hull, Petrides et al., 2017); fear of being bullied and retaliation by others; and shame associated with their ASD identity (Cage & Troxwell-Whitman, 2019).

The use of camouflaging strategies in school-aged ASD females has been supported by some studies. For example, teachers tend to report fewer concerns for girls with ASD than boys with ASD (Hiller et al., 2014), as girls with ASD show less severe social difficulties than boys with ASD in school settings (Sedgewick et al., 2016), while boys with ASD reportedly exhibit more significant behavioral problems than girls with ASD at school (Mandy et al., 2012). However, teachers are not to be blamed for the under-identification of ASD-related challenges in girls with ASD. There is much speculation that current diagnostic tools may lack sensitivity to identify unique female-typical manifestations of autism, because they have been designed and validated mainly using male samples (Kreiser & White, 2014; Lai et al., 2015; Mandy & Lai, 2017). Additionally, behavioral symptoms in girls with ASD could be difficult for clinicians or teachers to identify, because girls tend to engage in camouflaging behaviors to mask their ASD symptoms more significantly than boys with ASD. Therefore, due to gender-based expectations of autism and camouflaging behavior, many girls with ASD are simply viewed as being shy or

well-behaved by their teachers (Attwood, 2007), leading to much fewer referrals (Kreiser & White, 2014).

Regarding emotion regulation, contrary to the hypothesis, the present study showed that gender differences in Emotion Regulation Index (ERI) did not reach a statistically significant level, even though the mean score of emotion regulation was slightly higher in girls than in boys. Perhaps, no gender difference was found in emotion regulation, because the current study utilized ERI, which consisted of two subscales of shift (that is, cognitive flexibility and emotional control). This could have diffused subtle differences between the genders. As such, a different outcome could have been observed, if each subscale had been compared separately. For instance, White et al. (2017) demonstrated significant gender differences in all subscales in the BRIEF, indicating that girls with ASD had more problems with everyday EF than boys with ASD. Nonetheless, the gender difference in the shift is inconclusive, as one study found no gender difference in the shift measured by a performance-based task (Bölte et al., 2011), while the other study found a significant gender difference using the same task (Memari et al., 2013). Thus, further investigation is warranted to examine gender differences in emotion regulation and shift, using both performance-based tasks and a behavior rating scale, in a larger sample of female children and adolescents with ASD.

The present study also proved that staggering numbers of participants reportedly experienced elevated levels of everyday EF challenges (behavior regulation *T* score ≥ 65 = 59% and emotion regulation *T* score ≥ 65 = 73%). This confirms Hill's hypothesis describing EF challenges in several ASD children and adolescents. Their behavior and emotion regulation challenges should not be overlooked, since developing these self-regulation skills is crucial for mental health and navigating socially enriched environments successfully. For example, behavior

regulation skills involve controlling impulses (i.e., inhibition) and understanding how their behavior may affect others (i.e., self-monitoring), while emotion regulation skills involve shifting attention, moving from one situation to another (i.e., cognitive flexibility), and adjusting emotional responses (i.e., emotion control). These skills become essential in maintaining optimum social communications and interactions, such as taking turns, following up with questions, asking questions about others' interests, and transitioning from one activity to another. Accordingly, a recent study indicated that behavior regulation skills measured by the BRIEF significantly predicted children's verbal conversation skills (Hutchison et al., 2020). This means that behavior regulation challenges could further influence the development of optimal social relationships. Also, another study showed that children with better emotion regulation skills had better social skills and fewer behavior problems than those with poor emotion regulation skills, in the ASD sample (Berkovits et al., 2017). As a result, ASD children and adolescents are likely to struggle in developing optimal social relationships without these self-regulation skills and may require interventions targeting these skills.

Association Between Internalizing Problems and Everyday EF

The third research question aimed to investigate the association between internalizing problems and everyday EF after removing the effect of confounding factors affecting the association in ASD children. Before the primary analyses for this research question, this study examined correlations between internalizing problems and everyday EF, without removing the effect of confounding factors, using Pearson correlation analysis. The analysis revealed that each construct of internalizing problems and everyday EF had weak to moderate correlations. However, different outcomes were observed when the associations between internalizing problems and everyday EF were examined after removing the effect of age, cognitive ability, and

ASD severity. First, regarding the association between behavior regulation and internalizing problems, consistent with the hypotheses, a significant positive association was found only with depressive problems but not with anxiety problems. Prior studies also showed similar findings: behavior regulation did not predict anxiety problems (e.g., Gardiner & Iarocci, 2018; Wallance et al., 2016), but it predicted depressive problems in ASD children (Gardiner & Iarocci, 2018). Nonetheless, a longitudinal study indicated that challenges with behavior regulation predicted both anxiety and depressive problems two years later in ASD children, such that those who struggled with behavior regulation seemed to be at high risk of developing internalizing problems later in their lives (Vogan et al., 2018). Therefore, it remains unclear if behavior regulation problems are associated with anxiety problems in the ASD population, and further investigation is warranted.

Third, contrary to the hypotheses, the analyses revealed no significant associations between emotion regulation problems and anxiety or depressive problems. Most previous studies investigating the association between everyday EF and internalizing problems utilized the previous edition of the BRIEF, which did not have the ERI. Therefore, this study was the first to investigate the specific association between ERI and internalizing problems. That said, prior studies have examined the associations between the subscales within ERI (that is, shift and emotional control) and internalizing problems. These studies showed that challenges with shift and emotional control were significantly related to internalizing problems in ASD samples (e.g., Hollocks et al., 2014; Gotham et al., 2015; Gardiner & Iarocci, 2018). Thus, the failure to find an association between emotion regulation problems and internalizing problems in the present study is puzzling. This suggests that other unaccounted factors may be mediating the association between emotion regulation and internalizing problems in ASD children.

For example, empirical research suggested that emotion and behavior dysregulations might be risk factors for psychopathology in the general population as well as the ASD population, since effective self-regulation is considered to play a critical role in mental health (Bender et al., 2012; Cracco et al., 2017; Epkins et al., 2013; Garnefski & Kraaij, 2018; Hu et al., 2014; van Steensel et al., 2011; White et al., 2014). Furthermore, some researchers hypothesized that emotion dysregulation in the ASD population might be linked to their use of maladaptive emotion regulation strategies, which could lead to internalizing problems (Cai et al., 2018; Conner et al., 2020; Mazefsky et al., 2014). Khor et al. (2014) investigated maladaptive coping strategies and emotional problems in ASD adolescents. They found that participants' use of disengagement coping, wherein they avoided or denied emotions and thoughts emerging from stressors, was significantly associated with higher levels of behavior and emotional problems.

Similarly, another study showed that participants using involuntary disengagement (for example, numbing, inaction) after social stressors reportedly experienced more significant depressive problems. Also, the use of maladaptive emotional strategies (for example, rumination, intrusive thoughts) was associated with more significant anxiety and depressive problems in ASD adolescents (Mazefsky et al., 2014). Samson et al. (2015) has indicated that, unfortunately, several ASD adolescents use maladaptive emotion regulation strategies (e.g., emotional numbing, inaction) more than adaptive emotion regulation strategies (e.g., cognitive reappraisal). On the other hand, using more adaptive emotion regulation strategies is shown to act as a protective factor in the mental health of ASD children and adolescents (Cai et al., 2018). Thus, future studies may examine if adaptive coping strategies mediate the association between emotion regulation and internalizing problems, and if interventions targeting maladaptive emotional strategies influence emotion regulation in ASD children and adolescents.

Finally, the present study demonstrated that participants with ASD struggled significantly with behavior and emotion regulation problems in their everyday lives. Also, more than half of the participants experienced significant anxiety and depressive problems. These children and adolescents with emotion and behavior regulation problems need support in their school settings, and school psychologists play a significant role in helping ASD students to develop adaptive emotion and behavior regulation strategies. Furthermore, as seen in this study, several ASD students require interventions specifically targeting underlying factors that influence emotional and behavioral challenges. In the next section, implications for school psychology practice are discussed.

Implications

The study's findings have some implications for school psychology practice. First, as demonstrated, several ASD children and adolescents suffered from internalizing problems, and these students would need support from educators and mental health professionals, such as school psychologists, in school settings. Furthermore, for ASD students, regardless of whether they receive special education, schools can be particularly challenging environments, because they struggle to engage in meaningful social interactions or develop relationships. There are several benefits of school-based mental health services, such as convenient location, less stigmatized setting, and school psychologists with daily access to students (Doll et al., 2017). Thus, providing behavioral and mental health services in school settings will be beneficial for ASD students, to avoid the additional challenges and obstacles, which could make ASD-related symptoms worse. Such services will help them achieve social and educational success.

That being said, school psychologists should not rely on ASD diagnosis alone to make intervention decisions for students, because such an approach will fail to recognize their unique

challenges and needs. Instead, school psychologists must use the cultural-ecological model to evaluate specific areas (e.g., co-occurring emotional and behavioral problems) related to students' challenges, as it requires expanding of views to examine the multilayered interactive systems and thus address environmental factors serving as barriers to the student's development and psychological well-being. In addition, school psychologists need to seek scientific research to inform their assessment and evaluation processes of ASD students. As evidenced in the present study, although several participants suffer from internalizing problems and EF challenges, not all ASD children experience these challenges. This is also supported by other research (e.g., Dajani et al., 2016; Geurts et al., 2014). Furthermore, many students with clinical diagnosis of ASD do not receive special education services. For example, it is reported that much fewer female and Black students with ASD receive an educational diagnosis of ASD than the estimated CDC prevalence rate of ASD (Barnard-Brak, 2019). Thus, school psychologists must use consultation and collaboration strategies to understand each student's unique challenges and must work with educators to provide individually tailored care and services.

Second, as the study indicated, many ASD children and adolescents may have significant challenges related to everyday EF and may need to develop self-regulation skills to navigate social environments successfully. In other words, some of the interventions commonly provided for ASD children, such as social skills interventions, may not be sufficient for ASD students to develop optimal social relationships, unless their behavior and emotion regulation skills are improved. As a result, ASD students with EF challenges will need an intervention that targets the underlying source of their problems. For example, Unstuck and On Target (UOT; Cannon et al., 2011) is a school-based cognitive-behavioral intervention that helps children improve challenges related to EF deficits. Kenworthy et al. (2014) show that UOT is much more effective than a

social skills intervention targeting only social communication skills. Also, UOT is superior in not only advancing social skills but also improving shift, problem-solving, and planning/organizing skills. In addition, the improvement in flexibility (i.e., shift), such as making transitions, following rules, and not getting stuck, is significant post UOT. The participants' shift score measured by the BRIEF decreased from the clinically elevated level during preintervention to within the normal range after the intervention (Kenworthy et al., 2014). As such, accurately identifying underlying factors related to students' challenges will make a significant difference in intervention decisions, as it leads to providing more effective intervention in school psychology practice.

Third, the present study showed that girls with ASD might experience more EF challenges. Hence, school psychologists must become expert consumers of research, to evaluate current findings on gender differences and specific challenges experienced by girls and females with ASD. Research shows that there are numerous differences in observable behaviors between girls and boys with ASD, such as differences in social-emotional reciprocity, verbal and nonverbal gestures, a topic of interest, and frequency of restricted and repetitive behaviors, to name a few (see Hiller et al., 2014 for review). As supported by the Camouflage hypothesis, more girls than boys with ASD reportedly engage in camouflaging, creating obstacles in identifying their behavioral and emotional challenges. That being said, if educators fail to notice students' challenges related to ASD, it will delay a referral for ASD assessment or the opportunity to receive services from a health care provider. Public schools should be viewed as the primary mental healthcare providers for many children, because communication and behavioral concerns related to ASD are often first noticed by their educators. Therefore, school

psychologists must possess considerable knowledge of unique presentations of ASD, in order to provide support and early interventions that many ASD students need.

Limitations

Although the present study provided some insights into potential gender differences and some of the challenges that ASD children and adolescents experience, it is essential to recognize the study's limitations. First, although a power analysis indicated that the study had a sufficient number of participants for the analyses and maintains a suggested ASD gender ratio of 3:1, the small sample size is one of the study's limitations. Future studies need to include a larger sample of females with ASD, to understand if gender differences may exist in internalizing problems.

Second, all the assessments were conducted for clinical purposes, and the study used secondary data analyses (i.e., data were collected retrospectively) to answer the research questions. Additionally, this study used a single informant design (i.e., a parent or a caregiver), and the researcher did not observe the participants' challenges. In other words, the challenges of the participants were based on their parents' and caregivers' observations at home, which limited understanding of their difficulties or abilities. Furthermore, since internalizing problems are experienced within an individual, some may argue that using parent rating scales to assess their internalizing problems might pose some problems with validity. For example, Kanne et al. (2009) show that parents report significantly more concerns about their child's internalizing problems than their teachers, suggesting that ASD children may exhibit their challenges differently across different environments. Although the behavior rating scale used in the study has good diagnostic accuracy in detecting the presence of internalizing problems in ASD children (Magyar & Pandofli, 2017), it is critical to gather information about a child using

multiple-informant designs including self-report (e.g., interview) and observation of participants in multiple settings with peers, in future studies.

Finally, this study utilized the behavior rating scale to measure everyday EF in ASD participants, even though Hill's hypothesis has been developed based on findings of traditional neuropsychological tasks to measure EF. Although the behavior rating scale to evaluate EF has better ecological validity than performance-based tasks, the results from the rating scale may not be interpreted as reflective of performance-based tasks. Moreover, everyday EF involves multiple executive and non-executive processes (Snyder et al., 2015). Hence, assessing EF abilities using performance-based neuropsychological tasks along with a behavior rating scale in future studies will provide much more comprehensive information about children's abilities and challenges. Similarly, this study included a clinical sample of ASD children using the convenience sampling method; hence, the findings cannot be generalized to the overall ASD population. Future studies need to include ASD children with varied ASD severity, to examine if the challenges experienced are similar among ASD children with different levels of ASD severity.

Conclusion

This dissertation investigated gender differences in internalizing problems and everyday EF and the associations between these variables in a clinical sample of ASD children and adolescents. It showed that many ASD children and adolescents experienced significant challenges related to internalizing problems and everyday EF. In addition, a significant gender difference was found in behavior regulation, and girls with ASD had more challenges with behavior regulation in their everyday lives. Furthermore, behavior regulation was associated with participants' depressive problems, and as behavior regulation problems increased, so did

depressive problems in the sample. This highlights the importance of early identification of their challenges.

In a recent article, Lazarus et al. (2021) argue that school mental health services need to work not just on preventing and alleviating students' challenges but also promoting all students' psychological well-being. Not only ASD students but all students need a school culture and environment, which allows them to embrace their differences without feeling ashamed of their identity or unique characteristics. Teaching specific skills, such as emotion regulation strategies and developing EF skills, will be important for ASD students to promote their mental health. More importantly, teaching *all* students to welcome individual differences will be vital to promoting psychological well-being and diversity in school settings.

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Bachelor of Science in Business – Accounting ..... July 2004
University of Nevada, Las Vegas

INTERNSHIP (APA ACCREDITED)

Cypress Fairbanks Independent School District .....August 2022 – June 2023
Supervisors: John Nomura, Ph.D., LP, LSSP, Kelsey Perez, Ph.D., LP, LSSP, Charles Hallmark, Ph.D., LP, LSSP, and Jamie Griffin, Ph.D., LP, LSSP

Conducted emotional and behavioral functioning evaluations for disability conditions such as autism, emotional disturbance, ADHD, and disruptive behavior disorders. Provided family therapy services to families and their children, as well as treatment planning and progress monitoring. Evaluations for special education programming, such as Related Services Evaluations and Functional Behavioral Assessments. Provided a variety of psychological services for both general education and special education students. Provided pre-referral intervention that includes consultation with parents and school staff regarding behavioral, social, and academic concerns; social skills or other psycho-educational groups; and time-limited evidence-based interventions for preventative mental health concerns. Provided direct psychological services, such as individual counseling and group counseling with students, and indirect psychological services, such as behavioral consultation with teachers, parents, and outside service providers. Supervision with licensed psychologists consisted of weekly individual and group meetings with digital video review, reviewing cases, interpretation of results, integrated report revisions, and discussion of feedback.

SUPERVISED PRE-DOCTORAL CLINICAL EXPERIENCE

Clinical Settings

Grant a Gift Autism Foundation Ackerman Center in Alliance with UNLV Health..... Aug. 2019 – Dec. 2021
Advanced Practicum Student
Supervisors: Julie Beasley, Ph.D., LP; L. Caitlin Cook, Ph.D., LP; Katherine Lee, Ph.D., LP, NCSP

Conducted neuropsychological assessments using a flexible battery of psychometrically validated tests for clients from young children through young adults with various challenges and diagnoses, such as autism spectrum disorder, attention-deficit/hyperactivity disorder, intellectual disabilities, genetic disorders, fetal alcohol spectrum disorders (FASD), and behavioral and emotional disorders. Participated in multidisciplinary team evaluations as part of an FASD and drug effect clinic assessment team. Facilitated social skills development groups for children, adolescents, and young adults with autism spectrum disorder or FASD. Further responsibilities included conducting intake assessments, interviewing clients, scoring and interpreting assessments, conceptualizing cases, completing full clinical report writing, developing recommendations for treatment, and providing feedback to clients and their families. Served as a research team member and engaged in various clinical research projects, such as reviewing research and creating a database for grants, as well as collecting data for the clinic's FASD study. Supervision with licensed psychologists consisted of weekly individual and group meetings with digital video review, reviewing cases, training in case conceptualization, joint determination of evidence-based assessment battery and interpretation of results, integrated report revisions, and discussion of feedback.

The P.R.A.C.T.I.C.E. Community Mental Health Clinic .. Aug. 2017 – May 2018/July 2019 – Aug. 2019
Practicum Student/Advanced Practicum Student
Supervisors: Scott Loe, Ph.D., NCSP; Katherine Lee, Ph.D., LP, NCSP

Conducted psychoeducational and psychodiagnostic assessments using a flexible battery of psychometrically validated tests for children referred from the community with a range of referral questions. Further responsibilities included conducting intake assessment, interviewing, scoring, interpretation, integrated report writing, differential diagnosis, and providing feedback to patients. Supervision with a licensed psychologist consisted of weekly individual and group meetings with digital video review, reviewing cases, training in case conceptualization, joint determination of evidence-based assessment battery and interpretation of results, integrated report revisions, and discussion of feedback.

School Settings

Lilly & Wing Fong Elementary School (Grades PreK, K-5)..... August 2017 – May 2019
Practicum Student, Advanced Practicum Student
Supervisors: Brendon Ross, Ed.S., NCSP, Katherine Lee, Ph.D., LP, NCSP; Lara Conrad, Ph.D., LP, NCSP

Conducted psychoeducational assessments for multidisciplinary team (MDT) evaluations, attended MDT meetings, and wrote MDT reports that identified students' intellectual, academic, and social strengths and weaknesses to provide evidence-based instructional strategies. Attended weekly RTI meetings with the principal, assistant principal, learning strategist, teachers, and school psychologist. Consulted teachers regarding their students and collaborated with them to meet students' needs. Observed students in classroom settings and collected data for consultation and observation notes in MDT reports. Provided feedback to parents, teachers, and students. Assisted during crisis interventions. Group supervision occurred weekly with a licensed

psychologist off-site. In-vivo supervision occurred regularly by a licensed school psychologist on-site.

Ed W. Clark High School (Grades 9-12)..... January 2019 – May 2019
Advanced Practicum Student
Supervisors: Brendon Ross, Ed.S.; NCSP, Katherine Lee, Ph.D., LP, NCSP; Lara Conrad, Ph.D., LP, NCSP

Conducted psychoeducational assessments for MDT evaluations, attended MDT meetings, and wrote MDT reports that identified students' intellectual, academic, and social strengths and weaknesses to provide evidence-based instructional strategies. Consulted teachers regarding their students and collaborated with them to meet students' needs. Assisted preparations for individual and group therapy for students. Engaged in case management tasks to meet students' needs. Group supervision occurred weekly with a licensed psychologist off-site. In-vivo supervision occurred regularly by a licensed school psychologist on-site.

Education Advocacy Clinic at William S. Boyd School of Law, UNLV... January 2019 – May 2019
Educational Advocate
Supervisors: Rebecca Nathanson, Ph.D., and Leslie Murdock, Ph.D., JD.

Provided education and support to families, attended individualized educational plan (IEP) meetings with families, provided consultation to schools, and collaborated with foster care placements as appropriate. Clients were all children and siblings who had been placed in the foster care system as a result of severe physical and emotional abuse and neglect. Supervision occurred weekly in groups and included a review of documentation, case rounds, and discussion.

Somerset Academy – Stephanie Campus (Grades K-12)..... August 2017 – May 2018
Practicum Student
Supervisor: Katherine Lee, Ph.D., LP, NCSP

Conducted psychoeducational assessments for multidisciplinary team (MDT) evaluations. Attended MDT meetings and wrote MDT reports that identified students' intellectual, academic, and social strengths and weaknesses to provide evidence-based instructional strategies. Supervision occurred weekly in groups and included a review of documentation, case rounds, and discussion.

PROFESSIONAL EXPERIENCE

Desert Parkway Behavioral Healthcare Hospital.....July 2015 – June 2018
Assessment and Referral Counselor

Conducted screenings and assessments to determine the needs of treatment and the appropriate level of care for patients and their families. Provided counseling services and referrals to facilitate their access to the appropriate care and treatment for patients and their families. Consulted with a psychiatrist to determine appropriate provisional diagnoses of a patient using

the DSM-5. Communicated assessment results to patients, their families, medical staff, and other hospital staff for admissions or other treatment. Arranged acute psychiatric admissions from the emergency room of various hospitals in Las Vegas, NV. Provided tele-counseling for individuals seeking mental health and substance use treatment and gave treatment recommendations. Wrote progress reports of assessment results and obtained pre-authorization from insurance companies by providing clinical assessment results.

RESEARCH EXPERIENCE & PUBLICATIONS/PRESENTATIONS

School Psychology Review (SPR)..... April 2020 – May 2022
Student Editorial Board Member
Mentor: Samuel Song, Ph.D.

Nominated by an editorial board member to serve as a Student Editorial Board (SEB) member. Engaged in the peer-review process and prepared high-quality constructive reviews for authors of submitted manuscripts in a timely manner. Conducted three to five peer reviews per year. Participated in the SPR editorial board meeting at the NASP conference.

Publications:

- **Mullner, H**., Song, S., Eliot, M., & Beasley, J. (under review). The association between anxiety and everyday executive functions in children with autism: Comparing autism samples of different levels of cognitive ability.
- Song, S., Leverett, P., **Mullner, H**., & Milner, T. (under review). Social justice in school psychology from a global perspective. *Oxford Handbook of Social Justice in School Psychology*. Oxford Press.

Conference Presentations:

- **Mullner, H.** & Song, S. (2018, July). Supporting English language learners: Disentangling literacy development and language impairments. *Paper presented at the annual conference for the International School Psychology Association (ISPA), Tokyo, Japan.*
- **Mullner, H.** & Song, S. (2019, August). High school dropout in English language learners in Nevada: Understanding their challenges. *Poster presented at the annual convention for the American Psychological Association (APA), Chicago, Illinois.*
- **Mullner, H.** & Wright, D. (2020, February). A current review of executive function in children with specific language impairment. *Poster presented at the annual conference for the CARE conference (CARE), Las Vegas, Nevada.*
- **Mullner, H.** (2022, February). Gender differences in internalizing problems and everyday behaviors associated with executive function in children and adolescents with autism spectrum disorder. *Accepted proposal for paper presentation at the National Association of School Psychologists (NASP) annual convention, Boston, Massachusetts.*

FOREIGN LANGUAGE SKILLS

- Native in Japanese