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Indices of Emotion Regulation and Their Relation to Early Literacy in Children With ASD

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ABSTRACT OF THE THESIS

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by

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This study examined emotion regulation within the context of autism spectrum disorders (ASD) and its relation to early literacy skills in students with ASD in children participating in a larger longitudinal study of school transition experiences. Participants (*N*=145) were assessed during the spring of their current school year on measures of early literacy using AIMSweb universal screening measures. An exploratory factory analysis of the *Emotion Regulation Checklist* identified five factors associated with emotion regulation in children (i.e., *Negativity/Mood Dysregulation*, *Impulsivity*, *Affective Displays*, *Emotion Regulation*, and *Flexibility*). Correlation analyses revealed that *Emotion Regulation* was positively correlated with AIMSweb Letter Naming Fluency (LNF) for children in Pre-Kindergarten and Kindergarten and negatively correlated with AIMSweb Phoneme Segmentation Fluency (PSF). Parenting ratings of impulsivity were also linked to child performance on AIMSweb Nonsense Word Fluency (NWF). Implications for future research in the validity of ER assessment and its relation to school outcomes in ASD are also discussed.

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Indices of Emotion Regulation and Their Relation to Early Literacy in Children with ASD

One of the greatest challenges facing public education is the rise of autism spectrum disorders (ASDs). In a 2002 report, only 2.6% of students who qualified for special education met diagnostic criteria for autism (Kurth & Mastergeorge, 2010). About a decade later, autism was found to represent 10.4% of all students enrolled in special education in the state of California (California Department of Education, 2013). Recently, the number of children with ASD in all-inclusive settings has more than tripled, with some spending more than half their time in general education settings (Kurth & Mastergeorge, 2010). Although admirable efforts have been made towards inclusive programming for these children, the number of children diagnosed with autism (1 out of 68; Center for Disease Control and Prevention, 2014) far exceeds the availability of services schools are able to provide.

Students with ASD pose unique instructional challenges due to their deficits in the areas of language, socio-communicative functioning (i.e., difficulty with interpersonal interactions and understanding of others' perspective), and atypical patterns of behavior (American Psychological Association, 2013; Thompson, 2010). In some cases, students on the spectrum present a discrepant profile; for example, their level of cognitive functioning may be high or certainly in the typically-developing range, while they have deficits in their socio-emotional maturity. This profile can make successful transition to school all the more difficult (Stahmer & Ingersoll, 2004). Indeed the heterogeneous nature of ASD allows variability in student academic, social, and behavioral

competencies (Jahromi, Bryce, & Swanson, 2013). Certain subgroups of children have been identified as having different patterns of ASD symptomology, including diversity in their behavioral and emotional presentations (Pearson, Loveland, & Lachar et al., 2007) as well in their academic competencies (Ashburner, Ziviani, & Rodger, 2010). Recently, research has drawn attention to child self-regulatory processes and their relationship to social-emotional functioning in children with ASD. In typically developing children, individual differences in self-regulatory processes have been shown to influence students' approaches to learning and overall school readiness (Eisenberg, Valiente, & Eggum, 2014; Rimm-Kaufman, Pianta, & Cox, 2000).

More importantly, factors that contribute to the development of certain regulatory processes such as emotion regulation and the context through which it develops have not been fully examined along the continuum of ASD. Although researchers have suggested that mature emotion regulation may serve as an early indicator of academic success in typically developing students (Graziano, Reavis, Keane, & Calkins, 2007), the relationship between emotion regulation and academic achievement in children with ASD has yet to be explored, specifically during the early school transition period. This study will attempt to examine this relationship, using data gathered from a measure of emotion regulation and child performance on early indicators of literacy.

Emotion Regulation

Although continuous debate exists in the literature, there is an emerging consensus that emotion regulation (ER) cannot be confined to a single unidimensional construct (Fox & Calkins, 2003; Halberstadt, Denham, & Dunsmore, 2001; Thompson,

1994). Perhaps the most prominent definition in the literature is one proposed by Thompson (1994) as the interplay of "extrinsic and intrinsic processes responsible for monitoring, evaluating, and modifying emotional reactions, especially their intensive and temporal features, to accomplish one's goals" (pg.28). The intrinsic mechanisms alluded to here consist of variations in affective, cognitive, and behavioral responses. When regulated, the interplay between cognitive and behavioral systems is typically characterized by the inhibition of dominant behavioral responses elicited by the environment (Rothbart, Sheese, Rueda, & Posner, 2011). In other words, automatic responses are suppressed and replaced with behaviors that are more adaptive to the immediate situational context (Rothbart et al., 2011). Not surprisingly, cognitive processes related to ER (i.e., attention, working memory, planning, and inhibitory control), are perhaps the most susceptible to individual variation due to maturational changes and environmental influences (Carlson & Wang, 2007). Successful integration of these different systems at an early age allows children to effectively relay social information from their environment and consciously modify their reactive responses. By doing so, children are better able to match their emotional experience of events and understanding of others' emotions in response to their own behavior (Denham, Mitchell-Copeland, Strandberg, Auerbach, & Blair 1997; Halberstadt, Denham, & Dunsmore, 2001).

Due to the intricate nature of simultaneous systems acting in concert, ER is not solely comprised of self-regulatory behaviors; it also refers to the extent to which individuals are flexible in their regulation and use of strategies (Calkins & Hill, 2007;

Cole, Martin, & Dennis, 2004; Eisenberg & Spinrad, 2004; Thompson, 1994). Much of the existing literature in ER suggests a continuum of regulatory development signifying differences at the individual level (Carlson & Wang, 2007; Rothbart, 2007). Evidently, during the preschool period, children begin identifying ways to manage and adjust to distressing situations. Children also learn crucial skills that allow them to express their emotions in an acceptable and socially appropriate manner (Fox & Calkins, 2003; Neuenschwander, Röthlisberger, Cimeli, Roebers, 2012; Saarni, 1999). By age four, children already demonstrate emotional awareness (i.e., knowledge of basic emotions) and begin employing regulatory strategies (Fox & Calkins, 2003). As children get older, the distinction between simple and complex emotions becomes more transparent. Children are better equipped to handle emotionally charged events and attribute emotional value to certain experiences over others, a process known as "down-regulation" (Cole, Dennis, Smith-Simon, & Cohen, 2009). Children who experience difficulty down-regulating emotionally charged situations may be more likely to respond negatively with aggressive behavior (Miller, Fine, Gouley, Seifer, Dickstein, & Shields, 2006). Thus, the ability to synchronize these regulatory systems early on in development may bring about the foundational skills necessary for children's early socialization and adaptive emotion regulation (McClelland & Cameron, 2012).

Researchers have suggested that adaptive displays of ER predict positive social outcomes later in life. Children who display adaptive ER strategies during their early years in school are more likely to demonstrate better social skills that lead to positive experiences with peers (i.e., popularity with peers, friendliness, and prosocial behavior)

and successful adaptation to school (Carlson & Wang, 2007; Eisenberg, Valiente, & Eggum, 2010; Mostow, Izard, Fine & Trentacosta, 2002). However, children's mastery of these skills may be contingent on their ability to express emotions effectively, understand and respond to others' emotions appropriately, and continuous exposure to patterns of reinforcement that help facilitate interactions within a social context (Denham et al., 1997).

Conversely, children who lack social and emotional competencies and exhibit maladaptive regulatory coping strategies represent the other end of the ER continuum. Compared to their more regulated peers, children demonstrating poor emotion regulation are typically characterized by an imbalance of systems existing at both the biological and behavioral level (Neuenschwander et al., 2012; Rothbart, 2007; Rothbart & Bates, 2006). It has been suggested that children who display difficulties in ER have not fully developed the mechanisms involved in the process of "willful" controlling of emotional responses to stressful events (Eisenberg, Fabes, Nyman, Bernzweig, & Pinuelas, 1994; Eisenberg et al., 1997). These children are often characterized as showing more negative affect and are more likely to demonstrate disruptive behavior problems and reactive patterns of behavior (i.e., aggression and emotional outbursts) (Eisenberg, Sadovsky, & Spinrad, 2005). Children lacking in components of emotional competence are more likely to display higher rates of externalizing problems, negative emotional expressiveness, poor peer interactions, negative ratings of social competence and academic achievement (Cumberland-Li, Eisenberg, Champion, Gershoff, & Fabes, 2003). For children who are developmentally delayed, this becomes more problematic due to their increased

likelihood of displaying more behavioral dysregulation compared to typically developing children (McIntyre, Blacher, & Baker, 2006). For children with ASD, integration of these systems may be inherently flawed due to deficits in socio-communicative abilities that may deter normative development in self-regulatory behaviors (Weiss, Thomson, & Chan, 2014).

Emotion Regulation and ASD. Implications from previous studies suggest that emotion regulation is quite variable in young children (Fox & Calkins, 2003; Graziano, Reavis, Keane, Calkins, 2007). In general, research has shown that students with developmental delays present with deficits in self-regulation and often lack strategies in emotional awareness, planning, and ability to delay gratification (McIntyre et al., 2006). However, this relationship has not been fully explored in children with ASD, let alone in children with high functioning autism (HFA). The inherent rigidity characteristic of individuals with ASD makes it difficult for children to implement flexible approaches to problem-solving, a noted hallmark of well-regulated children (Weiss et al., 2014). Children on the spectrum may find it especially difficult to display such flexibility when confronted with unexpected emotional experiences and unprecedented changes in their environment (Ashburner et al., 2010). Additionally, children with HFA are typically more socially withdrawn and anxious (Locke, Ishjima, Kasari, & London, 2010). Thus, individuals with ASD may be more likely to engage in escape maintained behaviors in response to emotionally aversive situations in order to refrain from social situations altogether (Jahromi, Meek, & Ober-Reynolds, 2012). Evidence from the literature suggests that individuals with ASD (specifically, HFA) are more likely to employ ER

strategies that suppress expression of emotions, are more likely to identify and describe emotions inappropriately and poorly, and experience more negative emotions compared to positive emotions (Samson, Huber, & Gross, 2012).

Adaptive uses of ER strategies (i.e., implementation of strategies that match contextual demands) have been associated with long-term adjustment and overall psychological well-being (Aldao & Nolen-Hoeksema, 2012; McLaughlin, Hatzenbuehler, Mennin, & Nolen-Hoeksema, 2011). For children with HFA, the risk for future psychopathology appears to be more pronounced due to their increased use of maladaptive ER strategies such as emotional suppression and behavioral inflexibility (McPheeters, Davis, Navarre II, & Scott, 2011; Pearson, Loveland, & Lachar, 2006). Since children with ASD typically display greater emotional dysregulatation and are more likely to manifest poor psychosocial adjustment in later development, it is important to investigate successful uses of adaptive ER strategies during early childhood, which may circumvent the risk of future psychopathology. Not surprisingly, children with ASD and co-occurring behavioral and emotional difficulties tend to exhibit greater difficulties in learning and management of behavior problems (Ashburner et al., 2010; Pearson et al., 2006).

Overall, research indicates that well-regulated children are better equipped to handle emotionally arousing events (Denham et al., 2007). Once established, self-regulatory processes serve as either protective or risk factors for child social maladjustment and academic risk. Hence, studying the mechanisms that contribute to regulatory processes in a unique risk population that already exhibits a higher prevalence

of psychopathology is of utmost importance. Since these challenges manifest themselves early on during the early school transition period, regulatory deficiencies may present even greater concerns for school personnel beyond those associated with core autism deficits (Gadow, Devincent, Pomeroy, & Azizian, 2005; Pearson et al., 2006).

The Relationship Between Emotion Regulation and Academic Performance

The simultaneous occurrence of behavior problems, ASD symptomatology, and emerging psychopathology that is characteristic of some children on the spectrum place these children at increased risk for academic difficulties resulting from behavioral challenges. Unfortunately, many children with ASD lack the sufficient linguistic skills to effectively communicate and express their needs at the intrapersonal and interpersonal level (Prizant, Wetherby, Rubin, & Laurant, 2003). Although children with higher cognitive skills and language capabilities are more adept at comprehending their social world and expressing their feelings (Denham, Bassett, & Wyatt, 2007), children with HFA continue to struggle with social-emotional understanding, despite having relatively normal intelligence and expressive language (Bacon, Fein, Morris, Waterhouse, & Allen, 1998). For this reason, it is important to investigate the role child regulatory processes play in enhancing early school outcomes, because children who are lacking in self-regulatory abilities are often those who also have other challenging behaviors, as reported by parents or teachers (Ashburner et al., 2010; Jahromi et al., 2012; Prizant, et al., 2003)

Inability to regulate emotional arousal and attention during key academic years may interfere with the quality of instruction and student level of engagement (e.g., child opportunities to respond, participate, learn), thus impacting academic achievement

(Graziano, Reavis, Keane, Calkins, 2007; McClelland & Cameron, 2012). Certain components of self-regulation (i.e., cognitive and attentional flexibility, joint-attention, effortful control, and working memory) in normative and atypical populations, has shown strong relationships to later ratings of social competence and early adaptation to school, with effects lasting well into adolescence (Eisenberg et al., 2010). Children demonstrating difficulty in emotion regulation upon school entry will often display inappropriate behavioral responses, such as failing to self-regulate, pay attention, and following teacher's directives, impacting both academic achievement and peer acceptance (Eisenberg et al., 2010). Emotion regulation thus may serve as an early indicator of school readiness. One study found that almost half of kindergarten teachers reported that more than half of their students did not demonstrate basic regulatory skills or school readiness upon school entry (Rimm-Kaufman, Pianta, & Cox, 2000). Furthermore, the current literature suggests that child self-regulatory processes may be responsible for the development of behavioral competencies necessary for school readiness and may in fact mediate differences in student academic achievement (Blair, 2003; Eisenberg et al., 2010, Graziano et al., 2007.

Howse and colleagues (2003) found that emotion regulation in typically developing (TD) children in preschool predicted achievement in kindergarten (Howse, Calkins, Anastopoulos, Keane, & Shelton, 2010). Children were assessed in preschool and at kindergarten with standardized measures of achievement (e.g., listening comprehension, literacy and math composites). Parents and teachers completed measures assessing child problem behaviors, emotional competencies, and self-regulatory strategies

used by the child. Child emotion regulation (ER) was coded through observation of a frustration task. Findings from the study were in the expected direction. After controlling for child IQ, children higher in ER were more likely to outperform children with lower levels of ER (Howse et al., 2010). More importantly, the relationship between emotion regulation and achievement was mediated by child behavioral self-regulation (i.e., ability to focus attention and complete tasks). Interestingly, both emotion regulation and behavioral self-regulation were related to scores on listening comprehension. It has been suggested by some researchers that if children are to develop proficiency in oral language, the ability to focus attention may be an important prerequisite to the development of listening comprehension and later reading comprehension (Davidson & Weisner, 2013).

In another study examining the associations between behavioral regulation and preschoolers' academic outcomes, McClelland and colleagues (2007) hypothesized that gains in behavioral regulation would significantly predict growth in emergent literacy and vocabulary. The study examined variability and growth within a sample of four year-old students (N=217) entering preschool. Students were assessed for emergent literacy skills and expressive vocabulary using the Woodcock Johnson-III Tests of Achievement (WJ-III, Woodcock Johnson, 2001). Behavioral regulation was measured in the lab using a Head-to-Toes task (HTKS, Ponitz, McClelland, Jewkes, Connor, Farris, & Morrison, 2008), which is a measure of child inhibitory control. Results indicated positive correlations between behavioral regulation and all three measures of academic achievement across the two time-points (Fall and Spring). Additionally, children who

demonstrated more growth in behavioral regulation from Fall to Spring, were more likely to make greater academic gains in literacy and vocabulary, compared to students who showed less growth in behavioral regulation. Findings from this study suggested that children with higher behavioral regulation and self-control, on average, outperformed students on measures of achievement and may have been better equipped to handle the academic demands encountered during the early school transition period. However, emotion related self-regulation has yet to be examined in relation to measures of achievement in students with ASD.

Academic Performance in ASD

As previously mentioned, a growing challenge for educators is the successful inclusion of children with ASD in general education settings (Crossland & Dunlap, 2012). Research suggests that compared to typically developing students, students with autism are under-achieving (Ashburner, Rodger, & Ziviani, 2010). Poor academic achievement may be attributed to behavior problems, difficulty with transitions, and variability in cognitive and verbal abilities (Mazefsky, Herrington, & Siegel et al., 2013). Furthermore, children on the spectrum are not accustomed to embracing changes in their daily schedules or routines. Nonetheless, throughout a regular day, frequent changes in settings, social input, and interruptions of preferred interests can result in negative emotional responses (i.e., tantrums, impulsive behaviors, self-injury) for children (Mazefsky et al., 2013). Ashburner and colleagues (2010) investigated teacher's perceptions of the academic performance of their students with ASD and children's ability to regulate their emotions and behaviors in the classroom. Teachers rated and

compared their students with ASD to students who were typically developing and enrolled in the same classroom. A case-control study design was implemented to match and compare students with ASD students (N=28) with age-and-gender matched TD peers (N=51). Overall findings from the study indicated that teachers were more likely to rate children with ASD as exhibiting higher externalizing problems (i.e., oppositional defiant behaviors and aggressive behavior) compared to their TD peers (Ashburner et al., 2010).

Most importantly, about half of students with ASD (53%) showed significant impairment in their emotional ability compared to any other measures collected. This finding suggests that students with ASD may display greater emotional difficulties (i.e., unpredictable mood swings, temper outbursts, tendency to be easily frustrated, and high rigidity) compared to typically developing students in an academic setting (Ashburner et al., 2010). However, this study must be considered with limitations in that teachers, with prior knowledge of the student's diagnoses, may have exhibited bias in their ratings and reports. Regardless of teacher bias, it is evident that the emotional difficulties experienced by students with ASD, may undermine the capacity of students to perform commensurate to their ability.

Emergent Literacy in ASD. Research has yet to show whether academic strengths in children with ASD (e.g., average decoding ability and letter-word knowledge) during the early school years serve a protective function in mediating the impact of problem behaviors and child emotional self-regulatory strategies. The early school years are an important formative period in the acquisition of emergent literacy skills (Juel, Griffith, & Gough, 1986). Emergent literacy comprises features associated

with oral language, phonological processing (i.e., phonological sensitivity, lexical access, and phonological memory), and letter-word knowledge (Torgeson, 2002; Whitehurst & Lonigan, 1998). Taken together, these skills have been shown to be a robust predictor of later reading ability (Juel, 1998; Lonigan, Burgess, & Anthony, 2000; Wagner & Torgesen, 1987; Whitehurst & Lonigan, 1998).

In a recent study conducted by Gabig (2010), children with ASD were compared to typically developing children on early reading measures of phonological awareness (PA). Fourteen children with autism between the ages of five and eight years old were matched to a control group of TD peers. All the children in the study completed measures of oral language, word recognition, and phonological awareness. Findings from the study indicated that children with ASD were significantly lower in phonological awareness skills (e.g., segmenting of sounds) and produced below average scores compared to TD peers. However, compared to their TD peers, children with ASD scored within the normative range on early reading skills and word recognition. These results were consistent with findings from previous studies examining relationships between word recognition and PA in children with ASD (Davidson & Weismer, 2013; Nation, Clarke, Wright, & Williams, 2006).

The imbalance between the ability to decode and the ability to comprehend words in text is a common profile in readers with ASD (Frith & Snowling, 1983). Studies examining the prevalence of hyperlexia (i.e., an above average ability to read words despite a poor ability to comprehend spoken language) in children with ASD often find that reading profiles are fairly accurate in depicting the reading abilities of children with

ASD (Gabig, 2010). For instance, one study by Nation and colleagues found that word reading skills are often found to be in the average range, or even higher, while reading comprehension tends to be fairly poor (Nation et al., 2006). This discrepancy between decoding and comprehension can be attributed to poor oral language (i.e., weak receptive language) and children's inability to use specific processing skills to organize details, e.g., deficits in weak central coherence (Happe & Frith, 2006). The heterogeneous nature of autism helps explain much of the variance in students' emergent reading skills and reading development. For example, although children with ASD perform lower on measures of receptive language compared to TD children, this specific deficit does not necessarily predict reading performance. In a sample of ASD children, expressive language ability was a better predictor of reading performance beyond children's receptive language skills (Davidson & Weismer, 2013) suggesting again that ASD characteristics account for unique variances to specific reading profiles within this population of students.

The hypothesis that children with ASD demonstrated strong word reading skills and decoding ability regardless of apparent weaknesses in phonological skills reflects evidence from the literature that will support the current study (Newman, Macomber, Naples, Babitz, Volkmar, & Grigorenko, 2007; Whalon, Otaiba, & Delano, 2009). In other words, it is hypothesized that children's early literacy performance will be comparable to published findings, or norms from criterion-based measures, from typically developing students on measures of letter-word knowledge and phonics.

Furthermore, it is expected that student performance on measures of early literacy will be related to their emotion regulation.

Methodology for Studying ER in ASD

As a construct, ER has been difficult to measure systematically using a method that captures all facets of socio-emotional development (Bridges et al., 2004; McClelland & Cameron, 2012; Thompson, 2011). Although behavior problems can be assessed quite adequately (Achenbach, Edelbrock, & Howell, 1987), assessing social-emotional development in atypical populations (such as children with ASD or co-occurring developmental psychopathologies) presents some challenges (Mazefsky et al., 2013; Weiss et al., 2014). Children with ASD often show a range of introspective skills and the inability to self-reflect, which may interfere with the assessment of their subjective experience and impede their appraisal of emotionally arousing events (McClelland & Cameron, 2012; Weiss et al., 2014). The present study will include an existing paper-pencil measure of emotion regulation, completed by an informant (in this case, mother) that has been widely used with typically developing children to assess the use of regulatory strategies in children.

The inherent social-communicative and emotional deficits of ASD have likely excluded this population from the study of emotional regulation. Thus, of the current measures used to assess ER, most have been used in non-ASD populations (Mazefsky et al., 2013; Weiss et al., 2014), creating the need to test the validity of current measures on their application to this particular population. The majority of studies typically assess unitary dimensions of ER through the use of a single instrument or method of assessment;

however these methods have provided a poor fit between theories in support of ER within the context of ASD (Weiss et al., 2014). Unfortunately, because children with ASD may not have the emotional awareness or sufficient language skills to convey changes in affective states, or express their use of strategies with sufficient detail through self-report, assessment of these domains is often contingent upon caregiver report or observation, which does not take into account the subjective experience of these children (Weiss et al., 2014).

Current Gaps in the Literature

Although studies have focused on the relation between emotion regulation and academic achievement in typically developing children (Graziano et al, 2007; Howse et al. 2003; McClelland et al., 2007; Trentacosta et al., 2006), researchers have yet to examine the relationship between ER and academic achievement in children with ASD. The transition to early schooling provides a critical period during which to study this relationship within the context of early literacy development. Literacy development is an important predictor of later reading achievement and school adjustment, which carries important implications for outcomes in adolescence and later adulthood (Juel, 1988). Since the roles of IQ and disability status present notable differences in acquisition of these skills upon school entry, and remain fairly stable throughout schooling, it is important to examine the unique contribution of regulatory behaviors of children with ASD that may predict above and beyond child characteristics that may be less amenable to change and intervention.

Additionally, researchers have yet to conclude whether the same processes involved in the regulatory development of typically developing children also applies to children with ASD. Studies examining differences in emotion regulation have proposed additional factors to consider in children with ASD (e.g., joint attention, effortful control, language, etc.) that may affect various components of ER (Jahromi et al., 2013; Weiss et al., 2014). The extent to which these early indicators of ER jointly affect early indicators of academic competence (i.e., early literacy skills) and how they contribute to children's overall performance on these measures is yet unknown.

Research Aims

The current study aims to address gaps in the current literature by validating the use of a measurement tool on emotion regulation for use with children with ASD, and to assess the relation of emotion regulation processes to emergent literacy skills of students with ASD. Specific questions include: (1) How many reliable and interpretable factors can be extracted from the Emotion Regulation Checklist (Shields & Cicchetti, 1997) in a sample of children with ASD? (2) To what extent are child indices of emotion regulation related to emergent literacy skills? (3) To what extent can parent ratings of children's emotion regulation strategies predict performance on early literacy skills above and beyond child and parent characteristics?

Methods

Participants

Participants in this study included 145 children ages 4 to 7 years old (121 boys, 24 girls) who were participating in a cross-site (California and Massachusetts), longitudinal

study. The purpose of the larger study was to examine correlates of successful school transition for young children on the spectrum, including the tracking of early literacy development and the quality of student-teacher relationships. Participants were referred to the study by local service agencies, schools, and state regional centers. A total of three cohorts of students were recruited, with each cohort subject to the same recruitment, eligibility and study procedures.

Enrollment in the larger study was contingent upon a previous clinical or school diagnosis of an autism spectrum disorder and an intelligence quotient (IQ) on the Wechsler Preschool and Primary Scales of Intelligence (WPPSI-III; Wechsler, 2002) of 55 or above. All children were screened as part of the study with the Autism Diagnostic Observation Schedule for Children (ADOS-2, Lord, Rutter, DiLavor, & Risi, 2008). Children were classified under autism or autism spectrum if they met ADOS score cut off criteria. In cases where children had no full psychological assessment and diagnosis, the Autism Diagnostic Interview-Revised (ADI-R; ADI-R; Rutter, LeCouteur, & Lord, 2003) was also administered to mothers to further determine eligibility. Participants in the ASD sample used for this particular study did not have a concurrent diagnosis of intellectual disability, that is, children with an estimated IQ score below 70 were excluded from the sample. Overall participant scores on the WPPSI-III had a mean FSIQ score within average levels of cognitive functioning (M= 93.82, SD= 13.33).

Table 1 shows participant demographics. The children were predominantly male (83.4%) and primarily White (73.1%). Only 40.8% of parents reported household incomes under $65,000. Mother education in this sample was defined by years of

completed schooling. Overall, most mothers in our sample completed high school (96.6%), with more than half of mothers reporting completion of a college degree or higher (63.4%). The majority of participants were enrolled in public elementary schools (59.7%) and public preschool programs (11.1%), with only a small percentage (3.5%) enrolled in private schools.

Procedure

The Institutional Review Boards of the participating universities approved study procedures. Informed consent forms were mailed home and then reviewed with parents, and collected from parents upon the day of the child's first assessment. Parents, in most cases mothers (N=131), completed measures of social skills and child behavior problems prior to each visit across multiple time points. Once deemed eligible, children were assessed at three separate time points, during the fall (Time 1) and spring (Time 2) of the current school year, and the winter (Time 3) of the following school year. This study utilized a paper and pencil measure completed by parents and child literacy data collected during the spring assessment (i.e., Time 2).

During the on-site assessment, graduate student researchers trained in the study procedures met separately with the child and mother to complete a variety of tasks. Activities included an interview on topics related to the child's behavior, relationships with his or her teacher and peers, school experiences and overall transition to school. Assessment of child behavior problems, social development, and emotion regulation strategies were obtained via mother-completed questionnaires.

Measures

Background information from the parent and child were obtained via a parent completed demographic questionnaire completed at the eligibility visit. Measures on early literacy and ER were collected from children and their parents at Time 2.

Eligibility: Autism Diagnostic Observation Schedule (ADOS; Lord, Rutter, DiLavor, & Risi, 2008). The ADOS is a standardized, semi-structured play-based observation of child behavior in situations that elicit autistic tendencies. There are four modules that can be administered, dependent on the child's verbal ability. The observation yields scores in four domains: Social Interaction, Communication, Stereotyped Behaviors and Restricted Interests, and Play. Of these domains, only two, Social Interaction and Communication, are included in the algorithm. The ADOS has established reliability and validity from research on a sample of children with a diagnosis of autism (Lord et al., 2008). The ADOS has high discriminative validity with high sensitivity (97%, 95%, and 90% across Modules 1 to 3, respectively) and specificity (94%, 87%, and 94%, across Modules 1 to 3, respectively) in discriminating between children with ASD and children without a spectrum disorder.

Eligibility: Autism Diagnostic Interview- Revised (ADI-R; Rutter, LeCouteur, & Lord, 2003). Some children were assessed further using the Autism Diagnostic Interview-Revised (ADI-R; Rutter, LeCouteur, & Lord, 2003), a 93-item parent interview. The ADI-R produces scores in three domains: Language/Communication, Reciprocal Social Interactions, and Restricted, Repetitive and Stereotyped Behaviors and Interests. In order for a child to meet diagnostic criteria, the child must meet the cut off score for each of the three domains assessed. The ADI-R has

very high test-retest reliability with coefficients ranging from .93 to .97. The ADI-R has high inter-rater reliability at .86 for the total score with overall diagnostic validity being the highest for children older than 20 months.

Eligibility: Wechsler Preschool and Primary Scale of Intelligence, Second Edition (WPPSI-III; Wechsler, 2002). Children's cognitive skills were measured with the WPPSI-III, an assessment instrument with sound psychometric properties. The WPPSI-III is composed of 14 subtests and yields an IQ score with M=100 and SD=15. For this study, a calculated Full Scale IQ (FSIQ) score was computed from an abbreviated measure of cognitive functioning, which included three subtests: block design, matrix reasoning and vocabulary subscales. This instrument is intended for use with children between the ages of 2:6 and 7:3 years of age. The selection of these three subtests was based on their established reliability (r = .95) and high predictive validity in gaining an estimate of cognitive ability (Sattler & Dumont, 2004).

Comprehensive Assessment of Spoken Language (CASL). Oral language was also measured using child performance on the Comprehensive Assessment of Spoken Language (CASL; Carrow-Woolfolk, 2008) at Time 1. The Syntax Construction and Pragmatic Judgment subtests were used from the CASL. These subtests have adequate internal consistency, with coefficients ranging from .73 to .88 for Syntax Construction across age groups, and .77 to .92 for Pragmatic Judgment. Test-retest reliability was adequate for these subtests (.79 for Syntax Construction and .73 for Pragmatic Judgment). For the purposes of these analyses, the standard scores for these two subtests were added together and then divided by two to create a distribution around a mean of

100. This score was then used in correlational analyses and later regression analyses as it related to some, but not all outcome variables.

Child Behavior Checklist (CBCL). Behavior problems were measured using parent report on the Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2000; 2001). Parents were asked to complete the items describing their child's functioning on a three point Likert scale (0 = not true, 1 = somewhat or sometimes true, 2 = very true or often true). Higher scores on subscales indicate greater levels of problematic behaviors. Depending on the child's age, parents were either administered the CBCL for ages 1.5 to 5, or for ages 6 to 18. For the purposes of this study, only the total problem scale was used. Test-retest reliability for the scale being used is .90 (ages 1.5 to 5) and .94 for ages 6 to 18. Reported correlations between parent and teacher reports for total problem behaviors are .65 (ages 1.5 to 5) and .80 (ages 6 to 18). There is strong evidence of discriminative, convergent and predictive validity, and demonstrates construct validity with the BASC-2 (.85 to .89) for total problems.

Study Measures: AIMSweb. At Time 2, participants' early literacy skills were assessed based on their age, in accordance with suggestions given by AIMSweb (Shinn & Shinn, 2002a; 2002b). AIMSweb tools are a series of timed, curriculum-based measurement (CBM) estimates used in schools for the purposes of universal screening. These tools are utilized for progress monitoring of children considered at risk for reading failure. During each time point, children's literacy skills were assessed with the appropriate reading probes for their age following the guidelines set forth by AIMSweb (Shinn & Shinn, 2002a; 2002b). This study utilized the following screening tools as

indicators of early literacy: letter naming fluency (LNF), letter sound fluency (LSF), phoneme segmentation fluency (PSF), nonsense word fluency (NWF), and reading curriculum-based measurement (R-CBM). LNF is a measure of children's ability to identify and name as many letters as they can in one minute. LSF is a measure of children's ability to recognize letters and identify individual letter sounds that match the letter. PSF is a measure of phonological awareness (PA), which is defined as children's ability to identify individual sounds in words (i.e., segmenting words). For instance, the examiner gives the child the word "mop" and the child would respond by giving all the sounds with "/m/o/p/." NWF is a phonics measure that measures children's ability to decode words that are not real words such as "lat" or "zej." The child is given a full list of words that do not exist in the English language and is asked to read as many nonsense words as he or she can in one minute. This measure provides two scores capturing children who can provide individual letter sounds but are unable to blend individual letter sounds into one word (number of correct letter sounds), and children who can decode, blend, and read the whole word fluently (number of whole words read). Finally, R-CBM was used as a measure of children's overall reading fluency. The child is asked to read a total of three passages in one minute, with the goal of reading as many words as he/she can in one minute. After one minute, the examiner records the median number of words read correctly and the median number of words read incorrectly for all three reading probes. The reading accuracy of the child can then be calculated by dividing the median words correct by the median total words read (correct plus incorrect).

Reliability coefficients across AIMSweb probes are .90 and above including estimates for test-retest, inter-rater, and split-half reliability coefficients (Pearson, 2012). R-CBM reliability estimates are moderately correlated with future reading achievement, which are indicative of adequate criterion validity (Pearson, 2012).

Study Measures: Emotion Regulation Checklist (ERC; Shields & Cicchetti, 1997). In order to measure children's behavioral display of emotion regulation, parents were asked to complete the Emotion Regulation Checklist (ERC). The ERC is a 24-item measure used to evaluate two domains of emotion regulation: Emotion Regulation (14 items) and Emotion Lability/Negativity (10 items). Items are scored using a 4-point likert scale (1=Never, 2=Sometimes, 3= Often, 4= Almost Always). The Emotion Regulation subscale includes items relating to affective displays of emotions and emotional self-awareness. Mothers were asked to rate how likely their child was to endorse certain emotional responses. Example items included statements such as, "Is empathic towards others" and "Can say when s/he is feeling sad, angry or mad, fearful or afraid." The Emotion Lability/Negativity subscale consists of items representing lack of flexibility, mood lability, and negative affect. Example items from this subscale include, "Is prone to angry outbursts" and "Exhibits wide mood swings." The two subscales show a moderate negative correlation (r = -.50, p< .001), suggesting the measurement of two distinct processes of children's emotional functioning. Internal consistencies for the ERC using Cronbach's alpha are reported as .96 for Lability/Negativity and .83 for Emotion Regulation with an overall reliability of .89 across all items.

Results

Exploratory factor analysis of the ERC. The first goal of the study was to determine the number of reliable and interpretable factors that could be extracted from the 24-item ERC in a sample of children with ASD. An exploratory factor analysis was conducted to test the validity of the Emotion Regulation Checklist (ERC; Shields & Cicchetti, 1997), for use with children with ASD. A maximum likelihood (ML) extraction method using orthogonal rotation (i.e., varimax) was conducted on the 24 items of the ERC. Prior to the analysis, six items were reverse coded (i.e., items 4, 5, 9, 11, 16, and 18) so that the scale for each item would go in the expected direction. The Kaiser-Meyer-Olkin (KMO) criterion verified the sampling adequacy for the analysis, KMO= .83. A KMO limit greater than .6 is typically recommended prior to proceeding with the analysis (Raykov & Marcoulides, 2008).

The initial analysis extracted factors using Kaiser's (1960) criterion for obtaining factors with eigenvalues with a value greater than 1. Six factors had eigenvalues over Kaiser's (1960) criterion. In combination the 6 factors explained 61% of the variance and demonstrated good fit to the data ($\chi^2 = 151.57$; $df = 147$; $p = .38$). Upon visual inspection of the scree plot, the point of inflexion also verified the retention of six factors. Only items with loadings greater in absolute value than .30 were included, as the communality (shared variance) is more salient and easier to interpret through the removal of low correlations (Raykov & Marcoulides, 2008). Most items loaded heavily on factors 1 (27%) and 2 (12%) and the number of items loading on the remainder of factors seemed to decrease, especially with factors 5 (5%) and 6 (4%). In order to determine the optimal

number of factors to extract, the chi-square (χ^2) goodness-of-fit test was utilized to compare with the initial (EFA) results and determined the minimum number of factors that would result in a nonsignificant χ^2 value ($p > .05$). A significant chi-square value would indicate a general misfit to the data and would signify that the given factor model did not deviate significantly from the observed values.

An iterative process suggested the use of five factors for the final model ($\chi^2 = 168.21$, $df = 148$, $p = .12$). Factor 6 accounted for a small amount of variance (4.7%) and only two items loaded onto this factor. Further model reduction to four factors, was also not a viable option; although more parsimonious, it resulted in poor fit ($\chi^2 = 225.94$, $df = 186$; $p = .02$). In addition, item 12 (i.e., "Is whiny or clingy with adults") was completely removed from further analysis due to poor item fit (i.e., no factor loading >.3) and its irrelevance to the other factors. The five factors in combination explained 57.74% of the variance and showed an improved fit index that was nonsignificant compared to previous models with fewer factors ($p < .05$). The final factor loadings after rotation are displayed in Table 3. Reliability analyses using Cronbach's alpha were conducted on each scale in order to determine internal consistencies. Factors 1, 2, and 3 had the highest internal consistencies ($\alpha = .85$; $\alpha = .81$; $\alpha = .72$; respectively). Factor 4 had an internal consistency of .62, and factor 5 had the lowest internal consistency at .54, which suggests that the items in factor 5 were not as closely related as those in the other scales. It may have also been the case the items that loaded onto this factor were closely related, but the fact that only two items loaded onto it resulted in its low reliability estimate. The low

reliability estimates for the last two factors indicate that subsequent results related to these two factors should be interpreted with caution. See Table 4 for full descriptive statistics of the newly created factors. Factor scores were calculated for each participant to be used in subsequent analysis.

Factor 1 represented items related to *Emotion Negativity/Dysregulation* (e.g., variables such as "My child exhibits wild mood swings" and "Is prone to angry outbursts/tantrums easily" loaded highly on this factor); Factor 2 represented *Impulsivity* (e.g., variables such as "Is prone to disruptive outburst of energy and exuberance" and "Is impulsive" loaded highly on this factor); Factor 3 represented *Affective Displays* (e.g., variables such as "My child is cheerful" loaded highly on this factor). Finally factors 4 and 5, although consisting of fewer items, represented other important elements of ER. Factor 4 consisted of variables representing *Emotion Regulation* (e.g., variables such as "Can say when s/he is feeling sad, angry or mad, fearful or afraid" and "Is empathic towards others; shows concern when others are upset or distressed" loaded highly on this factor), which required the ability to discriminate between emotions and awareness or knowledge of other's emotions. Finally, factor 5 represented *Inflexibility* (e.g., variables such as reverse coded "Transitions well from one activity to another; does not become anxious, angry distressed or overly excited when moving form one activity to the next" loaded on this factor). Together these factors yielded a broader range of abilities that influence ER processes in children with ASD than the original scale did with typically developing children (Shield & Cicchetti, 1997).

ERC factors related to early literacy performance. The second aim of the current study was to determine whether indices of emotion regulation relate to measures of early literacy skills (i.e., AIMSweb measures). To address this research question, correlational analyses were conducted to examine which factors of the ERC measure, related to early literacy skills. AIMSweb raw scores were converted to standard scores for analyses using the means and standard deviations derived from the spring benchmark norms from a comparative sample of students made available through a national database. Means for AIMSweb measures are displayed in Table 4. Three factors showed moderate to strong correlations with literacy measures, specifically for children in Pre-K and Kindergarten. Higher ratings of *Emotion Regulation* were positively related to higher scores on *Letter Naming Fluency* (LNF) for preschoolers ($r = .33$, $p < .05$). However, an inverse relationship was found for *Phoneme Segmentation Fluency* (PSF), with higher scores on *Emotion Regulation* showing a negative correlation for students in kindergarten ($r = -.35$, $p < .05$). In other words, higher parent ratings on this factor were associated with lower PSF scores. Additionally, parent ratings of *Inflexibility* were negatively related to kindergarten scores on LNF ($r = -.40$, $p < .05$) and *Letter Sound Fluency*—LSF ($r = -.46$, $p < .01$), with higher scores on *inflexibility* factor related to lower child scores. Finally, higher ratings on the *Impulsivity* factor were related to higher scores on child *Nonsense Word Fluency* (NWF) for kindergartners, showing a positive relationship between these two variables ($r = .31$, $p < .05$).

Predictors of child literacy performance. The third and final question in this study sought to address the extent to which factors of ER predicted performance on

measures of early literacy above and beyond other child variables. Five separate hierarchical linear regressions were performed with each literacy measure as the outcome variable. Child and parent variables that correlated significantly with literacy measures were included as predictors in addition to ERC factors. The predictors were entered in two blocks, with parent or child variables entered in the first block and ERC factors entered in the second block. Prior to conducting the regression, all variables were correlated with one another to check for multicollinearity. Only variables that were correlated with the outcome were entered into the regression analyses. No variables correlated above .60 were found, therefore multicollinearity was not a concern.

Emotion Regulation factor. The first set of hierarchical regressions with Emotion Regulation as a predictor variable is summarized in Table 6. For the hierarchical regression using LNF PreK as an outcome, child IQ was entered into the model in the first block. The variance accounted for by this variable was 5% ($R^2 = .05$, $F = 2.41$, $p = .13$). In *Block 2*, the addition of parent-rated emotion regulation accounted for an additional 16% of the variance ($\Delta R^2 = .16$, $p < .05$), and the model variance accounted for remained significant ($R^2 = .21$, $F = 5.64$, $p = .01$). The final model accounted for 21% of the variance, indicating that both child IQ and parent-rated emotion regulation were significant predictors of LNF (at $p < .05$) for children in PreK.

For children in Kindergarten, child performance on PSF K is summarized in Table 6. In *Block 1*, child variables related to the outcome were entered (i.e., child IQ, language level on the CASL, and CBCL Total Problem behavior score), which accounted for 44% of the variance ($R^2 = .44$, $F = 5.93$, $p < .05$). In Block 2, the addition of parent-

ratings of emotion regulation accounted for an additional 6% of the variance ($\Delta R^2 = .06$, $p < .05$), and the model variance accounted for remained significant ($R^2 = .49$, $F = 5.31$, $p < .05$). In the final model, none of the predictors were found to be significant at the $p < .05$ level.

Inflexibility factor. The second set of hierarchical regressions with inflexibility as a predictor variable for performance on LNF and LSF for children in Kindergarten is summarized in Table 7. In the first hierarchical regression, child IQ was entered into the model in the first block. The variance accounted for by this variable was 13% ($R^2 = .13$, $F = 4.65$, $p < .05$). In *Block 2*, the addition of parent-rated inflexibility accounted for an additional 9% of the variance ($\Delta R^2 = .09$, $p < .05$), and the model variance accounted for remained significant ($R^2 = .22$, $F = 4.27$, $p < .05$). The final model accounted for 22% of the variance. Child IQ was a significant predictor, and inflexibility was not a significant predictor ($p < .10$).

For Kindergarten LSF, child variables related to the outcome were entered (i.e., child IQ and language level on the CASL), which accounted for 18% of the variance ($R^2 = .18$, $F = 2.68$, $p = .09$). In Block 2, the addition of parent-ratings of inflexibility only contributed an additional 9% of the variance ($\Delta R^2 = .09$, $p = .06$), and the model variance accounted for was not significant ($R^2 = .26$, $F = 2.84$, $p = .11$). In the final model, none of the predictors were found to be significant at the $p < .05$ level.

Impulsivity factor. The final hierarchical regression with Impulsivity as a predictor variable for NWF K is summarized in Table 8. In the first block, parent education, child IQ, and language level (as measured by the CASL), were entered into the

model. The variance accounted for by these variables was 27% ($R^2 = .27$, $F = 4.33$, $p < .05$). In *Block 2*, the addition of parent-rated impulsivity accounted for an additional 13% of the variance ($\Delta R^2 = .13$, $p < .05$), and the model variance accounted for remained significant ($R^2 = .40$, $F = 5.55$, $p < .01$). The final model accounted for 40% of the variance. In the final model, parent rated impulsivity was the only significant predictor (at $p < .05$) of child performance on NWF for children in Kindergarten.

Discussion

Children with ASD face an array of difficulties with self-regulatory behaviors, a critical component of ER. The inability to develop competencies in this area may impact other domains of functioning, especially with regards to school readiness (Jahromi et al., 2012). Although the early school transition can be challenging for children who are typically developing, the school transition period for children on the spectrum is burdened by additive risk factors (e.g., language delays, behavior problems, and social deficits) that only increase the likelihood of poor academic outcomes. Unfortunately, a majority of studies have typically focused on core diagnostic features of ASD and have neglected the potential impact of child dysregulation on academic skill acquisition above and beyond ASD symptomology. It was hypothesized that tools used to measure ER among typically developing children would prove useful in assessing ER in a young sample of children with ASD. The Emotion Regulation Checklist (ERC) is one such rating tool that has received support and extensive use in the literature as a valid measure of child emotion regulation (Shields & Cicchetti, 1997), and thus utilized in the current

study. In a normative sample, the measure is known to yield two factors of emotion regulation: *Emotion Regulation* and *Lability/Negativity*.

The first aim of the present study was to evaluate the effectiveness of the ERC for use with children with ASD. The results suggested that additional domains of ER were in fact captured by the measure than those previously cited in the literature when using this measure (i.e., *Negativity/Dysregulation*, *Impulsivity*, *Emotion Regulation*, *Affective Displays*, and *Inflexibility*). This finding is consistent with previous research highlighting differences in components of ER between children with ASD when compared to controls, further elucidating that aspects of ER in children with ASD are more likely to be rooted in child dysregulation (i.e., negativity, reactivity, and impulsivity) rather than adaptive emotion regulation (Jahromi et al., 2013). Additionally, *Negativity*, *Impulsivity* and *Inflexibility* factors yielded by the EFA are domains of ER that are commonly reported impairments in children with ASD. For instance, children with ASD are more likely to react impulsively to emotional stimuli (i.e., tantrum behavior), engage in self-injurious behaviors, and demonstrate negativity and aggressive behavior towards self and others (Mazefsky et al., 2013). Although children with ASD are more likely to demonstrate higher rates of maladaptive behaviors, as evidenced by comorbid behavior difficulties characteristic of this population (Pearson et al., 2006; McPheeters et al., 2011), researchers have proposed an alternative hypothesis suggesting that behavior challenges often result from difficulties in self-regulation (Neuenschwander et al., 2012). Children with ASD are more likely to employ inappropriate regulatory strategies that are not conducive to the development of prosocial behaviors or adaptive coping mechanisms

(Aldao & Nolen-Hoeksema; Jahromi et al., 2012). Not surprisingly, children with ASD also demonstrate rigid thinking patterns and difficulty with transitions, making it all the more difficult for children on the spectrum to adopt flexible approaches to adaptive ER strategies (Samson et al., 2012). The cognitive inflexibility demonstrated by children on the spectrum may present challenges in the teaching of critical skills (e.g., cognitive reappraisal) important for adaptive ER. Overall, results from the EFA appear to suggest that indices of regulation in ASD may be influenced by multiple facets co-occurring under the umbrella of ER, which explains the difficulty in conceptualizing ER within the context of ASD.

Another aim of the study was to investigate the relation of ER factors to measures of early literacy and its impact on child performance along these indicators of early reading performance. As predicted, certain factors (i.e., *Emotion Regulation* and *Impulsivity*) were significantly related to child performance on literacy measures, specifically on measures linked to the alphabetic principle. More importantly, these findings were only significant for children in Pre-K and Kindergarten. As expected, higher ratings on the *Emotion Regulation* factor showed a positive relationship with measures of letter-word knowledge (i.e., LNF). In other words, children with higher ratings of ER were more likely to demonstrate better performance on LNF regardless of child IQ. This relationship was only significant for children in Pre-K and was no longer significant for children in other grades participating in the study. Although LNF is not a direct measure of basic reading skills, it has been used as an indicator of early reading risk (i.e., predictive of later reading) (Good & Kaminski, 2002). This finding may suggest

that ER is an important predictor of reading risk prior to school entry, but may no longer contribute to reading performance later on. As children get older, it may be the case that other known variables inherent to ASD (i.e., poor oral language), contribute to the variability in reading performance and later reading comprehension.

Interestingly, performance on NWF (a measure of phonics) in relation to parent-related impulsivity was in an unexpected direction. Higher ratings on the child *Impulsivity* factor were associated with higher scores on NWF for children in Kindergarten. It may be possible that because phonics skills are a relative strength for children with ASD, skills deficits were not apparent during this task, despite parent report of impulsivity. Another possibility may be that children with ASD that are impulsive are less likely to demonstrate rigidity when having to read nonsense words. In other words, children who exhibit higher levels of rigidity may fixate on the fact that they are reading words that are not real, which would impact their performance (i.e., time on task) compared to the more impulsive child that may start reading regardless if the word is a real word. However, when examining the predictive relationship of this factor compared to other child variables, this relationship remained significant even after controlling for child (i.e., IQ and language) and parent variables (i.e., parent education). Research has suggested decoding skills and letter-word knowledge to be a relative strength for children with ASD (Nation et al., 2006). As stated in previous research, children with ASD appear to demonstrate adequate use of the alphabetic principle and phonics skills, showing performance well within average levels compared to same age matched controls (Nation et al., 2006). This study supported this trend with children performing in the average

range across these early literacy measures. Regardless of behavioral difficulties, children were still able to complete the task and identify letter-sound correspondences.

An interesting finding that may also seem counterintuitive is the negative relationship between the *Emotion Regulation* factor and PSF, where higher ratings on this factor were associated with lower performance on PSF (a measure of phonological awareness). A possible explanation for this finding may be in how this task was presented to children. Unlike other literacy probes, the PSF measure was verbally administered. The child listened to a word provided by the examiner, segmented the word into its individual phonemes, and verbally produced the individual phonemes in each word as fluently as possible. However, research has also implied that phonologically based skills are inconsistent within this population and show greater variability. Incongruent reader profiles in decoding and comprehension have been attributed to poor oral language (i.e., weak receptive language) and children's inability to use specific processing skills necessary for organizing details, e.g., deficits in weak central coherence (Happe & Frith, 2006). In other words, the heterogeneity of autism may account for much of the unexplained variance in student's emergent reading skills and reading development. Although poor performance was not necessarily related to ER in this study, lower scores on PSF may be indicative of general skill deficits in phonological processing for children on the spectrum that may be due to other impairments not captured in this study. Too, assessment of ER was collected through parent self-report, not an observable measure of ER. Moreover, the internal consistency estimate for this factor indicated that the factor may be unreliable, which could also explain this perplexing finding. With only three

items loading onto the *Emotion Regulation* factor, it may not be reliably capturing this construct. Future researchers may consider additional items related to this factor or other additional indices of child behavioral regulation to determine whether a more robust measure can be obtained.

Finally, the child *Inflexibility* factor was found to be negatively related to child LNF and LSF. The relationship indicated that children with higher ratings on this factor (i.e., greater difficulty with transitions) were likely to have lower scores on LNF and LSF. However, when considered in regression analysis, this factor was not a significant predictor of child performance on these two measures of literacy and did not contribute any additional variance above and beyond child IQ. It may be the case that children's ability to transition to this activity (i.e., from one literacy probe to the next) influenced performance on this measure that was unrelated to a child's actual ability to name or sound out letters. Like with the *Emotion Regulation* factor, the *Inflexibility* factor displayed poor reliability due to the number of items that loaded onto this factor.

Findings from the EFA appear to highlight other domains of ER worth investigating and support a multidimensional framework of ER within the context of ASD. Since children with ASD are at greater risk for behavior and social-emotional difficulties (Mazurek & Kanne, 2010), ER presents a rich area of study for identifying components of behavioral intervention that may contribute to later school success (Eisenberg et al., 2010). The behavioral profiles of children on the spectrum, along with their ASD symptomatology, may ultimately predict much of the emerging psychopathology within this population of children (Bauminger, Solomon, & Rogers,

2010; Matson & Nebel-Shwalm, 2007; Pearson et al., 2006). Persistent behavioral challenges over time often present challenges to overall school adjustment and student-teacher interactions, making instruction of early reading skills all the more difficult. Due to their social-communicative deficits and ER challenges, a transactional model of support as an alternative solution for addressing instructional challenges within this population of students may be prudent. With a focus on relationship building through social-emotional learning, this model seeks to address children's regulatory issues within educational and learning settings (Prizant, Wetherby, Rubin, & Laurent, 2003). One such model, known as SCERTS, places an emphasis on Social Communication, Emotion regulation, and Transactional Support, through a comprehensive program that addresses domains of development that promote positive outcomes in children with ASD (Prizant et al., 2003). By supporting these areas and individualizing instruction to match children's individual learning styles, this model aims to improve children's overall active engagement in learning. However, application of this model in school-based settings may be difficult due to limited resources and the extra staff support necessary to sustain it.

Finally, another important aim of this study was to examine the relationship between indices of ER as they relate to early literacy in children with ASD. Studies that have looked at this relationship in children with ASD are limited in that most measures used to assess achievement in this population have been standardized measures of assessment. While these measures are known to measure similar skills as CBM measures, the same time constraint is not applied, which places more demands on the child and may create more opportunities for behavior challenges. Standard administration of these

probes does not allow for deviance in the administrator protocol (e.g., pausing the timer once it is started), which may create challenges in administration if the child engages in self-stimulatory or disruptive behaviors. The task also requires children to remain seated and sustain their attention for short periods of time and shift their attention from one task to the next. This task may be extremely difficult for children on the spectrum who demonstrate co-occurring attention-related difficulties and task-avoidant behaviors. Although behavior challenges may interfere with the accurate assessment of skills using these measures, studies examining variability of performance along these measures will be informative to practice in schools. Because these measures are closely aligned with instruction, it is important to assess the extent to which these tools are useful in the assessment of early reading skills in children with ASD in order to inform instruction and intervention for later reading development.

Limitations and Future Directions

There are several limitations that precluded the testing of a comprehensive assessment of emotion regulation in our sample. First, the measurement of emotional regulation in our sample of students with ASD only included a parent self-reported index of ER. Reliance on parent report can be a limitation in the understanding of ER as a normative construct in children with ASD, and thus future studies should include additional observational measures of child self-regulation. The use of multi-faceted approaches can further elucidate the context through which these behaviors develop and are reinforced, carrying important implications for educational practices at home and at school. Future work should utilize such observations to investigate the extent to which

transactional processes (i.e., how parent and teacher interact with children with ASD and vice-versa, over time) reduce or increase the likelihood of child dysregulation.

Commonly used forms of emotion regulation assessment at present have included child physiological responses to stress (e.g., vagal tone or respiratory sinus arrhythmia), observations of parent-child dyadic interactions, and parent and teacher self-report measures (Mazefsky et al., 2013; McClelland & Cameron, 2012; Weiss et al., 2014). Such instruments have been used to examine both intrinsic and extrinsic factors related to ER and the role of context in developing regulatory competencies. Few measures actually examine the period prior to school age or school entry (ages 4-6) in which early transitional processes can be assessed (McClelland & Cameron, 2012; Rothbart, Posner, & Kieras, 2006). Additionally, few measures examined the use or implementation of regulatory strategies for regulating emotional experiences for children on the spectrum. Although the methods employed in this study present a limitation, the developmental period during which these processes were examined is a strength.

Lastly, because this study included a sample of young children with HFA, findings from this study cannot be generalized to all children on the autism spectrum. However, the sustained increase in the incidence of ASD diagnoses, coupled with the rising trend towards integrating these students into inclusive settings, suggests that general education teachers are more likely to provide instruction to this type of student with ASD. For these reasons, it is important to identify early predictors of school readiness that may contribute to the academic success of students with ASD, ER being one of the possible underlying mechanisms that influence a positive school transition.

Potential insight into the indices of ER that relate to early academic performance presents a framework within school-based settings necessary for examining these relationships more closely within the context they occur.

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Table 1
Participant Demographics

Variable	**ASD (*n=145)*** **M (SD)**
Child	
Age	5.05 (1.00)
WPPSI FSIQ	93.82 (13.33)
Gender (% Male)	83.45
Race (% Caucasian)	73.10
Mothers	
Income (% >$65,000)	40.85
Mother's Education (% college degree or higher)	63.44

Notes. 11% Latino, 7.6% Asian, 4.8% African American, and 2.8% Alaskan Native/Native American/ or Indigenous.

Table 2
EFA Factor Loadings After Rotation

My child…	Factors				
	ND	IMP	AD	ER	IFXL
2. Exhibits wild mood swings (child emotional state is difficult to anticipate because s/he moves quickly from positive to negative moods).	.66				
5. Can recover quickly from episodes of upset or distress (for example, does not pout or remain sullen, anxious or sad after emotionally distressing events).*	.42				
6. Is easily frustrated	.74				
8. Is prone to angry outburst/tantrums easily	.74				
14. Responds angrily to limit-setting by adults	.67				
19. Responds negatively to neutral or friendly overtures by peers (for example, may speak in an angry tone of voice or respond fearfully)	.51				
24. Displays negative emotions when attempting to engage others in play.	.41				
10. Takes pleasure in the distress of others (for example, laughs when another person gets hurt or punished; enjoys teasing others).		.34			
11. Can modulate excitement in emotionally arousing situations (for example, does not get "carried away" in high-energy play situations or overly excited in inappropriate contexts.*		.46			
13. Is prone to disruptive outburst of energy and exuberance.		.62			
17. Is overly exuberant when attempting to engage others in play		.69			
20. Is impulsive		.75			
22. Displays exuberance that		.42			

others find intrusive or disruptive			
1. Is a cheerful child.			
3. Responds positively to neutral or friendly overtures by adults.	.68		
7. Responds positively to neutral or friendly overtures by peers	.61		
16. Seems sad or listless*	.39		
18. Displays flat affect (expression is vacant and inexpressive; child seems emotionally absent)*			
15. Can say when s/he is feeling sad, angry or mad, fearful or afraid		.58	
21. Is empathic towards others; shows concern when others are upset or distressed		.75	
23. Displays appropriate negative emotions (anger, fear, frustration, distress) in response to hostile, aggressive or intrusive acts by peers		.32	
4. Transitions well from one activity to another; does not become anxious, angry distressed or overly excited when moving form one activity to the next*			.41
9. Is able to delay gratification*			.60

Note. *Item reverse coded; only loadings greater in absolute value than .3 were included, as the communality (shared variance) is then salient (Raykov & Marcoulides, 2008). ND= Negativity/Dysregulation; IMP=Impulsivity; AD= Affective Displays; ER= Emotion Regulation; and IFXL=Inflexibilty.

Table 3
Inter-Item Reliability Estimates

Factor	N	α	Mean (SD)	Variance
Neg./Dysreg.	7	.85	15.02 (3.99)	15.88
Impulsivity	6	.81	13.78 (3.75)	14.04
Affective Dis.	5	.72	16.12 (2.50)	6.22
Emotion Reg.	3	.62	7.54 (1.98)	3.90
Inflexibility	2	.54	5.50 (1.21)	1.47

Table 4
Sample Means on AIMSweb Literacy Probes

Probe	N	Min	Max	Mean (*SD*)
LNF PreK	46	80.31	140.31	103.75 (12.66)
LNFK	36	62.50	126.67	87.22 (15.44)
LSFK	36	63.44	119.69	80.03 (14.95)
PSFK	33	65.50	103.75	79.07 (10.69)
NWFK	45	73.13	167.50	94.96 (21.37)

Note. Sample means and standard deviations for AIMSweb literacy measures.

Table 5

Correlations for AIMSweb Literacy Probes with Factors

Variable	*Negativity/ Dysregulation*	*Impulsivity*	*Affective Displays*	*Emotion Regulation*	*Inflexibility*
LNF PreK	-.17	-.01	.20	.33*	.12
LNF K	-.04	.22	.05	.06	-.40*
LSF K	.03	.09	-.14	-.03	-.46**
PSF K	.24	.24	-.16	-.35*	-.12
NWF K	-.28	.31*	-.22	.22	-.06

Note. *$p < .05$, **$p < .01$; Parent-reported *Negativity/Dysregulation* factor; Parent-reported *Impulsivity* factor; Parent-reported *Affective Displays* factor ; Parent-reported *Emotion Regulation* Factor; Parent-reported *Inflexibility* factor; Child *Letter Naming Fluency (LNFPreK)* for Pre-Kindergarten; Child *LNF* for Kindergarten; Child *Letter Sound Fluency* (LSFK) for Kindergarten; Child *Phoneme Segmentation Fluency* for Kindergarten (PSFK); Child *Nonsense Word Fluency* for Kindergarten (NWFK).

Table 6

Regression Analysis with Emotion Regulation Factor—Outcome: Child LNF Pre-K and PSF K

Block	LNF PreK	*B*	SE *B*	β	R^2	Block	PSFK	B	SE *B*	β	R^2
1	FSIQ	.20	.13	.23	.05	1	FSIQ	.30	.19	.31	.44
							CASL	.12	.08	.29	
							CBCLTot	.42	.15	.44**	
2	FSIQ	.30	.12	.34*	.21	2	FSIQ	.23	.19	.23	.49
	Emotion Regulation	5.54	1.91	.41*			CASL	.13	.08	.33	
							CBCLTot	.32	.16	.34	
							Emotion Regulation	-3.66	2.38	-.26	

Note. *$p < .05$, ** $p < .01$; LNF PreK $F(2, 42) = 5.64$, $p = .01$; PSF K $F(4,22) = 5.31$, $p < .01$

Table 7

Regression Analysis with Inflexibility Factor—Outcome: Child LNF K and LSF K

Block	LNFK	*B*	SE *B*	β	R^2	Block	LSFK	B	SE *B*	β	R^2
1	FSIQ	.44	.20	.36*	.13	1	FSIQ	.13	.31	.10	.18
							CASL	.20	.13	.36	
2	FSIQ	.31	.21	.25	.22	2	FSIQ	.13	.30	.10	.26
	Infllex.	-6.12	3.26	$-.32^{+}$			CASL	.10	.14	.18	
							Infllex.	-6.42	3.86	-.34	

Note. *p< .05, ** p< .01, $^{+}$ p<.10; LNF K $F(2, 31)= 4.27$, $p<.05$; LSF K $F(3, 24)= 2.83$, $p=.06$

Table 8

Regression Analysis with Impulsivity Factor—Outcome: Child NWFK

Block	NWF K	*B*	SE *B*	β	R^2
1	Parent Education	2.52	1.91	.19	.27
	FSIQ	.39	.27	.27	
	CASL	.15	.12	.24	
2	Parent Education	3.13	1.78	.24	.40
	FSIQ	.37	.25	.26	
	CASL	.13	.11	.21	
	Impulsivity	7.25	2.74	.36*	

Note. *$p < .05$; $F(4,34) = 5.55$, $p < .01$