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Initial Feasibility and Efficacy of the Summer Treatment Program (STP-PreK) for Preschoolers With Autism Spectrum Disorder and Comorbid Externalizing Behavior Problems

Rosmary Ros-Demarize[1] and Paulo A. Graziano[2]

Abstract

The current study examined the feasibility and initial efficacy of the Summer Treatment Program for Pre-kindergarteners (STP-PreK) with 37 preschoolers with autism spectrum disorder (ASD) and externalizing behavior problems (EBP). Parents and teachers reported on children's behavior, social/adaptive skills, and self-regulation. Children completed a standardized achievement and executive functioning battery and an emotion knowledge task. The treatment was delivered with high levels of fidelity and was well received by families. Improvements were reported in parent-rated hyperactivity, inattention, aggression, and social and adaptive skills. Children also improved performance across academic achievement, emotion knowledge, and executive functioning and were rated by parents as having better executive functioning and emotion regulation. Findings highlight the initial efficacy of an established treatment in improving outcomes for preschoolers with ASD and EBP.

Keywords

autism spectrum disorder, externalizing behavior problems, school readiness, summer, treatment

Autism spectrum disorder (ASD) is a neurodevelopmental disorder marked by significant impairments in social interaction, communication, and restricted or repetitive behaviors (Ozonoff et al., 2007). According to the Centers for Disease Control and Prevention, ASD represents a large public health priority, affecting about one in 59 children in the United States (Baio et al., 2018), and is associated with a host of functional impairments within academic, social, adaptive, and cognitive domains (Howlin, 2003; Ozonoff et al., 2007; Stevens et al., 2000). Notably, children with ASD experience heightened levels of externalizing behavior problems (EBP), with 60% meeting diagnostic criteria for attention-deficit/hyperactivity disorder (ADHD; Goldstein & Schwebach, 2004). More recent work provides similar estimates,

[1]Medical University of South Carolina, Charleston, USA
[2]Florida International University, Miami, USA

Corresponding Author:
Paulo A. Graziano, Department of Psychology, Florida International University, Miami, FL 33199, USA.
Email: pgrazian@fiu.edu

suggesting that EBP, including aggression, oppositionality, inattention, and hyperactivity, are present in 33% to 70% of children with ASD (Gadow et al., 2004; Hartley et al., 2008; Lecavalier, 2006; Mazurek et al., 2013). Not surprisingly, children with ASD and EBP have poorer outcomes in social functioning and communication (Mazurek et al., 2013) as well as family functioning (Sikora et al., 2013). Despite well-documented comorbidity between ASD and EBP, further work is needed examining the joint impacts of ASD and EBP across other domains of functioning.

School Readiness

One domain that is particularly impaired for young children with ASD is school readiness. According to Rimm-Kaufman and Pianta's (2000), Ecological and Dynamic Model of Transition, the transition to kindergarten is marked by increased academic, behavioral, and social demands coupled with decreased supervision and need for autonomy. Given the aforementioned impairments inherent in young children with ASD, the transition from preschool to kindergarten is especially challenging (Forest et al., 2004). Similarly, children with EBP are often underprepared for meeting the demands of kindergarten, with lower rates of readiness within language, motor, and academic domains (Montes et al., 2012). Thus, school readiness for children with ASD and co-occurring EBP is of special interest given these transdiagnostic impairments.

Although traditional conceptualizations of school readiness emphasized the importance of emergent academic skills (Whitehurst & Lonigan, 1998), more recent models have taken a multidimensional approach highlighting the importance of academic, behavioral, and social-emotional readiness. Self-regulation, broadly defined as the control of emotions, behavior, and actions (Vohs & Baumeister, 2004), has also emerged as an important marker for school readiness (Bierman et al., 2008; Blair, 2002; McClelland et al., 2000). Specifically, self-regulation skills including executive functioning and emotion regulation have been implicated as essential for school readiness (Ursache et al., 2012). Executive functioning skills in the classroom allow students to modulate attention, whereas emotion regulation skills facilitate the control of emotions and frustration related to novel demands. Both executive functioning and emotion regulation have been associated with emergent academic skills (Blair, 2002; Clark et al., 2010).

Limitations of Current Treatments

Despite the impact of self-regulation on children's school readiness outcomes, limited treatments target self-regulation explicitly. While behavioral and pharmacological treatments, that often indirectly target self-regulation, have been successful for treating children with ADHD (Evans et al., 2014; Pelham & Fabiano, 2008), typical ASD treatments rely more exclusively on applied behavioral analysis (ABA; Newsom & Hovanitz, 2006). ABA has an ample evidence base with a recent meta-analysis documenting medium to large effect sizes for language, IQ, social skills, and adaptive skills (Peters-Scheffer et al., 2011). Of note, all 11 studies included in that review examined interventions that were individual and intensive in nature (e.g., 12–40 hr/week for 10 months–over 2 years). Furthermore, traditional approaches tend to focus on adaptive difficulties present in ASD (e.g., language, toileting) with few treatments focusing primarily on decreasing EBP. Not surprisingly, concerns have been raised about the cost-efficacy of current treatments for ASD (DeFilippis & Wagner, 2016). Thus, a need exists for cost-effective approaches that not only target multiple areas of functioning, but that can be delivered in briefer group formats.

Parent Training for ASD and EBP

Given the success of behavioral parent training (PT) programs for EBP (Evans et al., 2014; Pelham & Fabiano, 2008), it may be of utility to consider these approaches for the treatment of disruptive behaviors in ASD. Interestingly, the PT literatures for ASD and EBP have developed independently despite common roots in behavioral principles (Brookman-Frazee et al., 2006). Reviews demonstrate that larger numbers of programs for ASD focus on teaching parents to improve child adaptive skills rather than targeting parenting practices (Brookman-Frazee et al., 2006). Given the heightened presence of EBP in children with ASD, a more recent focus has emerged for traditional PT approaches, typically used with EBP samples, for children with ASD. A recent meta-analysis examined the efficacy of traditional PT approaches within samples of children with ASD (Postorino et al., 2017), including an individual PT program with 180 children with high-functioning ASD (Bearss et al., 2015). This meta-analysis reviewed studies examining PT across a relatively large age range (2–14 years). Thus, more work is needed examining traditional PT approaches for ASD that explicitly target disruptive behavior in younger children. One PT program specifically geared toward younger children is Parent-Child Interaction Therapy (PCIT), which has one of the largest evidence bases for reducing EBP in young children. However, the initial promise of PCIT for children with ASD has been largely limited to small open trial studies (Solomon et al., 2008; Zlomke et al., 2017) and case studies (Armstrong & Kimonis, 2013; Masse et al., 2016).

Timing of Interventions for ASD: Preschool Period

Aside from the need for ASD treatments that target important school readiness outcomes such as self-regulation and co-occurring EBP, timing of interventions is critical. Indeed, previous work has documented readiness upon school entry to be among the strongest predictors of later achievement (Duncan et al., 2007). Hence, much work has focused on improving outcomes for young children with ASD within a preschool setting. Given that that 50% of children receiving special education services for ASD spend at least 40% of time in general education, it is imperative to focus efforts on interventions that provide children with ASD and EBP skills to successfully participate in mainstream environments. More recently, a study examining the comparative efficacy of two preschool programs for children with ASD, the Learning Experiences and Alternative Program for Preschoolers and Their Parents (LEAP) and the TEACCH Autism Program, found both programs to be comparatively effective in improving outcomes for preschoolers with ASD (Boyd et al., 2014). While beneficial in targeting functioning across multiple domains, both LEAP and TEACCH represent yearlong interventions.

Timing of Interventions for ASD: Summer Transitions

Aside from developmental timing, seasonal timing of interventions may play an important role. Intervening during the summer months may be critical given the low levels of services often received during the summer months along with well-documented learning losses (Cooper et al., 2000). Thus, some work has focused on summer treatment camps for children with high-functioning ASD (Brookman et al., 2003; Lopata et al., 2006, 2008). However, these summer camps are focused on improving social skills and often are designed for older children. One summer program for young children with ASD was associated with improved verbal and social interaction skills (Walker et al., 2010). However, this program focused on improving social and adaptive skills, with no targets for EBP. In a study examining the Children's Summer Treatment Program (STP; Pelham et al., 2010) designed for children ages 6 to 11 with ADHD, children with high-functioning ASD experienced significant improvements in EBP (Sheridan-Mitchell et al., 2015). Nonetheless, it remains unclear how preschool children may benefit from such an intervention before the start of kindergarten.

STP-PreK

The Summer Treatment Program for Pre-Kindergartners (STP-PreK; Graziano et al., 2014; Graziano & Hart, 2016) was developed to target the critical transition to kindergarten for preschoolers with EBP. The STP-PreK is a comprehensive program that incorporates a behavior modification system and an academic and social-emotional curriculum focused on self-regulation training. Importantly, the STP-PreK also includes a concurrent school readiness PT program. Previous work has demonstrated the efficacy of the STP-PreK in improving school readiness (e.g., academics, behavior, social skills, self-regulation; Graziano et al., 2014; Graziano & Hart, 2016). However, children with ASD were excluded in the initial examination of the STP-PreK. Given the transdiagnostic impairments in school readiness and self-regulation, it is important to examine the efficacy of this of intervention with preschoolers with ASD and EBP.

The STP-PreK represents an ideal treatment modality for children with ASD and co-occurring EBP given the treatment components it encompasses as well as the timing of the intervention. Specifically, the STP-PreK's intensive behavior modification program and concurrent behavioral PT program target EBP behaviors in a classroom setting while still providing a parent directed component. Delivering the behavior modification program within the classroom component may be especially useful for children with ASD as it may aid to create further consistency between home and classroom-based behavioral expectations, which is particularly important for this population. Furthermore, improvements in behavior promoted via the parenting program along with a structured classroom component may yield improvements that generalize into the kindergarten classroom setting given the timing of the intervention (i.e., summer transition). In addition, the academic and social-emotional curriculum utilized within the STP-PreK may be beneficial in improving other school readiness domains that tend to be impaired in this population (e.g., early academic skills, social and adaptive functioning in the classroom).

The Current Study

Despite high rates of EBP among children with ASD (Goldstein & Schwebach, 2004), limited treatments for ASD directly address EBP with the majority of programs focusing on improving adaptive skills. While recent efforts have been successful in developing PT programs for treating EBP in young children with ASD (Bearss et al., 2015), programs have not directly targeted essential domains of school readiness, including self-regulation. In addition, programs do not explicitly target the transitional period between preschool and kindergarten, which may be especially important for young children with ASD. The current study examined the initial promise of an established intervention for preschoolers with EBP (i.e., STP-PreK) with a sample of children with ASD and EBP. The research questions that guided the current study are as follows:

Research Question 1 (RQ1): Are there improvements in behavioral, social-emotional, and adaptive functioning for preschoolers with ASD and EBP who participate in the STP-PreK? We expected that children who participated would improve across behavioral, social-emotional, and adaptive functioning measures.

Research Question 2 (RQ2): Are there improvements in academic functioning for preschoolers with ASD and EBP who participate in the STP-PreK? We expected that children who participated would improve across academic functioning measures.

Research Question 3 (RQ3): Are there improvements in self-regulation (i.e., executive functioning and emotion regulation) for preschoolers with ASD and EBP who participate in the STP-PreK? We expected that children who participated would improve on self-regulation (i.e., executive functioning and emotion regulation).

Method

Participants and Recruitment

The study was conducted at a large urban university in the Southeastern United States with a large Hispanic/Latino population. Families were recruited from local preschools and mental health agencies through brochures, radio ads, and open houses/parent workshops to participate in an intensive summer treatment program. Sixty-nine interested families completed a preliminary phone screening and were scheduled for a screening appointment. To qualify for the study, participants were required to (a) qualify for an ASD diagnosis via the Autism Diagnostic Interview–Revised (ADI-R; Rutter et al., 2003) OR have a previous documented diagnosis of ASD with elevated levels of ASD symptoms on the parent ($M = 66.37$, $SD = 7.64$) or teacher ($M = 67.03$, $SD = 10.64$) Autism Spectrum Rating Scale (ASRS; Goldstein & Naglieri, 2009); (b) have a *t* score of 60 or above on the Hyperactivity, Inattention, or Aggression Scale of the Behavior Assessment System for Children, 2nd Edition (BASC-2; Reynolds & Kamphaus, 2004) parent or teacher reports; (c) have an estimated verbal IQ of 65 or higher ($M = 86.29$, $SD = 17.83$) on the Wechsler Preschool and Primary Scale of Intelligence, 4th Edition (WPPSI-IV, Wechsler, 2012); (d) be either transitioning to kindergarten or prekindergarten in the fall; and (e) be able to attend a daily 8-week summer program.

Of note, previous multisite randomized trials of medication and combination treatments for children with ASD have utilized the ADI-R as a primary diagnostic inclusion measure (Arnold et al., 2000). Other studies examining the efficacy of summer programs for children with ASD have utilized documentation/records review of previous ASD diagnosis for inclusion (Lopata et al., 2006). Thus, for the current study, a more parsimonious approach was selected where previous documentation along with elevated current symptoms (based on the ASRS) was utilized for inclusion, whereas the ADI-R was used for determining ASD diagnosis for children without a previous diagnosis. In addition, consistent with previous work examining behavioral PT interventions for children with ASD (Solomon et al., 2008), a verbal IQ of 65 was deemed appropriate as the STP-PreK involved a classroom component where receptive and expressive language skills would be necessary.

Thirty-two children were excluded from this study due to not completing the screening process (i.e., no longer being interested or not completing screening questionnaires; $n = 17$), having verbal IQ scores below 65 ($n = 7$), the caregiver not being able to commit to attending camp for the 8 weeks ($n = 6$), or not having significant behavior problems as measured via the BASC-2 ($n = 2$).

The final participating sample consisted of 37 preschoolers (87% male, $M_{age} = 4.80$, $SD = .53$) with co-occurring ASD and EBP whose parents provided consent to participate in the study. Study questionnaires were completed primarily by mothers (84%) with a median income range between US$35,000 and US$50,000. See Table 1 for further demographic information on the sample. Participating children came from a range of preschool placements including mainstream and special education settings, with most children receiving a combination of services (e.g., mainstream with resource services). The majority of children were enrolled in public education programs.

Study Design

This study was approved by the university's institutional review board. A quasi-experimental design was used to examine the feasibility and initial efficacy of the STP-PreK in improving school readiness outcomes for preschoolers with ASD and elevated levels of EBP. All families participated in a pretreatment assessment and posttreatment assessment 1 to 2 weeks following the completion of the intervention and did not receive compensation for completing assessments.

Table 1. Sample Demographics.

Characteristic	Percentage in sample
Child race/ethnicity (%)	
Hispanic/Latino-White	73
Non-Hispanic/Latino-White	22
Other/Biracial	5
Family status (%)	
Intact biological family	81
Separated/divorced family	16
Single biological parent/adoptive family	3
Referral source	
Self	58
Mental health professional/physician	32
School personnel	11

As part of the pretreatment assessment, consenting caregivers brought their children to the clinic on two occasions and were videotaped during several tasks. During the first visit, clinicians administered the WPPSI-IV (Wechsler, 2012), the Bracken School Readiness Assessment (Bracken, 2002), and six subtests from the Woodcock-Johnson Test of Achievement (4th ed.; WJ-IV; Schrank et al., 2014). Consenting caregiver completed various questionnaires (described in further detail below) and participated in two structured interviews: the ADI-R (Rutter et al., 2003) and the Kiddie-Disruptive Behavior Disorder Schedule (K-DBDS; Keenan et al., 2007). Preschool teachers also completed various questionnaires on children's behavioral, social-emotional, and academic readiness (described in further detail below). Eligible participants were invited to attend a second visit, where children were administered standardized self-regulation assessments and objective social-emotional tasks.

All pretreatment assessments were readministered at the posttreatment assessment. Parents and kindergarten teachers were asked to complete posttreatment questionnaires. Of note, while parents completed posttreatment questionnaires within 2 weeks of completing the program, teachers generally completed posttreatment questionnaires at the beginning of the new school year about 1 to 2 months after the end of the program. For most children, a different teacher completed posttreatment ratings (i.e., kindergarten instead of preschool teacher) due to the timing of the summer intervention. A subsample of families also completed a 6-month follow-up assessment ($n = 27$) where laboratory tasks and standardized achievement measures were readministered as well as parent reports. Although all families were contacted for the follow-up assessment, nine families were not able to complete questionnaires and attend the clinic visit and one family resided in another state. Of note, there were no significant differences in demographic or study variables for families who completed the follow-up assessment and those who did not.

Intervention Description

Children participated in an 8-week summer treatment program for preschoolers (STP-PreK; Graziano et al., 2014; Graziano & Hart, 2016). The STP-PreK was run every weekday from 8:00 a.m. to 5:00 p.m. with periods of seatwork, large and small group activities, circle time, and recreational periods. The 37 children in the sample participated in the summer intervention across two separate cohorts and were assigned to classrooms of nine to 11 children. Only children participating in the study were in the intervention classrooms. No typically developing peers were included in the classrooms. Staff for each classroom included one lead teacher, one lead counselor, and four developmental aides, yielding a 1:2 ratio of staff to students. The

lead counselor and lead teacher for each classroom were an advanced clinical psychology graduate student and an elementary school teacher, respectively. The developmental aides were primarily undergraduate students with backgrounds in psychology or education. All staff underwent an extensive 10-day training in behavior modification for child behavior problems and demonstrated mastery of the STP-PreK manual, scoring at least 80 % on a procedural test. During training, lead teachers and lead counselors were trained to deliver the social-emotional, self-regulation, and academic curriculums with aid from supporting counselors (e.g., developmental aids). Supporting counselors were also responsible for aiding with the implementation of the behavior modification component of the intervention throughout the day. Of note, the only significant modification to the standard STP-PreK protocol was an increased staff-student ratio, which was modified from 1:3 to 1:2. The change in ratio represents an effort to approximate the current program to typical ASD services, which are often individual in nature.

Behavior modification component. The behavior modification program of the STP-PreK (Graziano et al., 2014; Graziano & Hart, 2016) entailed the use of positive reinforcement strategies such as a visual response cost system along with daily and weekly rewards. The classroom points and visual response cost system were carried out using a flip-card color chart. Children earn points for positive behaviors (e.g., sharing, helping) but may also lose points for breaking standard classroom rules (e.g., following instructions, remaining seated, being respectful). Importantly, social reinforcement is a key aspect of the behavior modification program as staff are to maintain an appropriate ratio of praise to rule violations (3:1) to support the positive reinforcement focus of the intervention. Children's points determined whether they needed to flip their card from green to yellow or red, which then corresponded to social reinforcement contingencies at the end of each class period and subsequently daily concrete reinforcers (e.g., treasure box). The behavior modification program also included the use of a daily report card which documented their points and color tracking for the day to be rewarded by parents at home. A time-out system was also utilized in the classroom for more serious behaviors (e.g., aggression, destruction of property, repeated noncompliance).

Social-emotional curriculum and self-regulation training. The STP-PreK social-emotional curriculum (Graziano et al., 2014; Graziano & Hart, 2016) was utilized during several daily class meetings (i.e., circle time for morning, mid-day, and end of day) focused on social-emotional development. During these meetings, a social skill and emotion of the day were reviewed using interactive activities. In addition, children participated in daily self-regulation training. These periods included practice of emotion regulation strategies for 15 min where children learned to identify and cope with various challenging situations through vignettes and role-plays. Self-regulation training also included daily participation in inhibition games (e.g., Red Light/Green Light, Orchestra) for 30 min based on a series of circle time games, which have been shown to improve executive functioning in preschoolers (Tominey & McClelland, 2011).

Academic curriculum. Children participated in daily centers and independent seatwork utilizing components of the Literacy Express Curriculum (Lonigan et al., 2005) consistent with the standard STP-PreK. Reading, writing, and math activities varied from whole group to small group to independent seatwork formats. All activities followed a theme of the week as outlined in the curriculum.

Parenting component. Parents also attended a school readiness parenting program each week for two hours (School Readiness Parenting Program [SRPP]; Graziano et al., 2018). The first half of each session focused on traditional PT aspects (e.g., improving the parent–child relationship, use

of reinforcement, time-out). Behavior management content was based on PCIT (Zisser & Eyberg, 2010) with four sessions focused on child-directed skills and four sessions focused on parent-directed skills. Parents practiced skills with their own children in groups while other parents observed. During the second half of each session, school readiness topics were discussed (e.g., using positive parenting during homework time, dialogic reading, communication with teachers). The SRPP was delivered by two graduate clinical psychology students under the supervision of a licensed clinical psychologist (second author).

Measures of Feasibility and Acceptability

Treatment fidelity. A full program day was observed weekly for each classroom, by a doctoral-level graduate student trained to code sessions using a treatment fidelity checklist. Fidelity checklists for the daily classroom component were completed per classroom activity and included whether classroom staff were adhering to the behavior modification system (e.g., implementing the point system, providing individual and group rewards, time-outs) and implementing the social-emotional and academic curriculums as appropriate to the activity. Importantly, fidelity checklists also included information on levels of social reinforcement being used throughout each activity (i.e., praise to rule violation ratios above 3:1). Fidelity for the parenting component (i.e., SRPP) was completed by a doctoral-level graduate student for two of eight sessions, with weekly group supervision provided by a licensed psychologist. Fidelity checklists for the parenting component included coverage of session content (e.g., providing overview, reviewing homework, coaching parent practice) as well as ratings of therapist engagement and social reinforcement during sessions.

Attendance. Attendance for each camp day was measured from counselors' contact notes and sign-in sheets completed by parents during drop-off and pick up. PT attendance was also collected for each parenting session.

Treatment satisfaction. Parents provided ratings of treatment satisfaction for the summer camp portion at posttreatment assessment via a standard satisfaction questionnaire. Parents indicated their degree of satisfaction using a 5-point Likert-type scale, which measured how much they and their child benefited, whether they would recommend the program to other parents, and how effective the program was compared with other treatment services they had received. Parents also provided ratings of treatment satisfaction for the parenting component by completing the Therapy Attitude Inventory (TAI; Brestan et al., 1999).

Measures of School Readiness

Behavioral, social-emotional, and adaptive functioning. To assess children's behavioral functioning parents and teachers were asked to complete the BASC-2 (Reynolds & Kamphaus, 2004) at the pretreatment assessment as well as at posttreatment. The BASC-2 has well-established internal consistency, reliability, and validity (Reynolds & Kamphaus, 2004). Gender and age normed *t* scores on the attention problems (current sample $\alpha = .74–.89$, inter-rater reliability = .18), hyperactivity (current sample $\alpha = .83–.91$, inter-rater reliability = .45), and aggression (current sample $\alpha = .73–.92$, inter-rater reliability = .42) subscales were examined as indicators of children's behavioral functioning. In addition, the social skills scale (current sample $\alpha = .78–.83$, inter-rater reliability = .30) of the BASC-2 was examined as a measure of parent- and teacher-reported social functioning. The social skills scale of the BASC has demonstrated convergent validity with other social functioning measures (Flanagan et al., 1996). Finally, the adaptive skills scale (current sample $\alpha = .79–.88$, inter-rater reliability = .29) of the BASC-2 was utilized

as a measure of parent- and teacher-reported adaptive functioning. Previous work has established the validity of the adaptive skills scale as it is associated with more traditional adaptive measures such as the Adaptive Behavior Assessment System (Papazoglou et al., 2013).

As objective measures of social-emotional functioning, children were administered the Emotion Knowledge Task (Denham, 1986) and the Challenging Situations Task (CST; Denham et al., 1994) at the pre- and posttreatment assessment. The emotion knowledge task requires children to both expressively and receptively identify eight emotions (e.g., sad, happy, angry, afraid, surprised) presented via cartoon and human faces. A total of 32 points is possible with higher scores indicative of better emotion knowledge. In the CST, children are presented with six hypothetical peer provocation situations (e.g., peer knocking down the target child's block tower) and are asked to provide an affective response (i.e., happy, sad, angry, and just okay) and how they would respond to that situation (i.e., prosocial, aggressive, crying, avoidant). A prosocial composite was created by subtracting the number of aggressive responses from the prosocial responses with higher scores indicative of better social problem-solving.

Academic functioning. At the pre- and posttreatment assessment visits, children were individually administered six subtests of the WJ-IV (Schrank et al., 2014), a widely used, norm-referenced measure of academic ability. Internal consistencies across subtests are generally high (.70–.90) along with good to excellent test–retest reliability (.70–.96; Mather & Woodcock, 2001). The six subtests administered were Applied Problems, Calculation, Writing Sample, Letter-Word Identification, Passage Comprehension, and Spelling. The current study examined standardized scores of the derived composite scores: *Brief Reading* (Letter-Word Identification, Passage Comprehension), *Brief Math* (Applied Problems, Calculation), and *Brief Writing* (Spelling, Writing Sample). Children were also individually administered the Bracken School Readiness Assessment (Bracken, 2002), a widely used kindergarten readiness test which consists of five subtests assessing children's receptive knowledge of colors, letters, numbers/counting, size/comparison, and shapes. The Bracken has strong psychometric properties and has been validated as a strong predictor of children's academic outcomes (Bracken, 2002; Panter & Bracken, 2009). For the purposes of this study, the overall school readiness composite standard score was used.

Parents and teachers were also asked to complete the Kindergarten Behavior and Academic Competency Scale (KBACS; Hart & Graziano, 2013), a 23-item questionnaire that requires parents and teachers to rate the extent to which the child is ready for kindergarten across various domains (e.g., following classroom rules, completing academic work) along a 5-point scale (*poor, fair, average, above average, excellent*). Of interest to the current study is the academic kindergarten readiness item, in which parents and teachers rate, on a scale from 1 to 100, how ready they feel the child is in meeting the academic demands of kindergarten compared with other same-aged children. Higher scores indicate a greater level of academic kindergarten readiness. The KBACS academic readiness item was used as a measure of academic kindergarten readiness at pre- and posttreatment (inter-rater reliability = .28).

Self-regulation: Executive functioning. At the pre- and posttreatment assessments, children were administered the Head-Toes-Knees-Shoulders task (HTKS; Ponitz et al., 2008). The HTKS is a widely used and psychometrically sound task used to assess executive functioning in preschoolers (Ponitz et al., 2009; Wanless et al., 2011) and has been validated in a sample of preschoolers with EBP (Graziano et al., 2015). In the HTKS task, children are provided with paired behavioral responses and asked to perform in the opposite way (e.g., touches head when prompted to touch toes). The measure is scored such that 2 points are awarded for a correct opposite response, 0 points for an incorrect response, and 1 point if any motion to the incorrect response is made but then self-corrected. Scores range from 0 to 40, with higher scores indicative of better executive functioning.

At the pre- and posttreatment assessment visits, children were also administered four subtests from the Automated Working Memory Assessment (AWMA; Alloway, 2007). The AWMA is a computer-based assessment of working memory skills for ages 4 to 22, including (a) Word Recall (auditory short-term memory), (b) Listening Recall (auditory working memory), (c) Dot Matrix (visuo-spatial short-term memory), and (d) Mister X (visuo-spatial working memory). Raw scores were converted to standard scores using gender and age norms. Scores from the AWMA show adequate test–retest reliability and have established convergent validity (Alloway et al., 2008). Given the high correlations among the subtests (r's .35–.65, $p < .05$), an average standardized score was calculated.

Parents and teachers completed the Behavior Rating Inventory of Executive Functions–Preschool Version (BRIEF-P; Gioia et al., 2003) at pre- and posttreatment. The parent and teacher versions contain 63 items, which yield five nonoverlapping but correlated clinical scales (inhibit, shift, emotional control, working memory, and plan-organize) with higher scores indicating poorer executive functioning. The BRIEF-P has well-established internal consistency, reliability, and validity (Isquith et al., 2004). Studies utilizing the BRIEF-P in samples of preschoolers with EBP have documented correlations between BRIEF-P scores and standardized measures of executive functioning (Graziano et al., 2015). For the purpose of the present study, the global executive functioning t score (current sample $\alpha = .93–.95$, inter-rater reliability = .18) was used.

Self-regulation: Emotion regulation. Parents and teachers completed the Emotion Regulation Checklist (ERC; Shields & Cicchetti, 1997) at pre- and posttreatment. For the present study, the Emotion Regulation scale was used, which assesses processes central to adaptive regulation. An abbreviated version of the ERC was completed by teachers and the Emotion Regulation scale of the ERC was also used (four items; current sample $\alpha = .75–.84$, inter-rater reliability = .18).

Data Analysis

All analyses were conducted using the Statistical Package for the Social Sciences (SPSS 23). There were no missing data for parent questionnaires and objective measures. However, 15 participants were missing data on either pre- or postteacher reports. According to Little's Missing Completely at Random Test, data were missing at random. All available data were used for each analysis. Descriptive data were provided to establish the feasibility and acceptability of the program. Of note, only two families dropped out of treatment and did not complete a posttreatment assessment. These two families were excluded from analyses including posttreatment data. Given the large number of outcomes, we ran separate repeated measures multiple analyses of variance (MANOVAs) for each outcome domain (i.e., all behavioral outcomes within one model, all academic outcomes within one model, etc.). Given the lower number of teacher reports available, teacher-rated outcomes were examined within separate models in an effort to use all available data. Additional analyses also examined follow-up data using repeated measures MANOVA and within subjects follow-up contrast tests to examine maintenance of changes from pretreatment to follow-up. Cohen's d effect size estimates were provided for all analyses.

Results

Preliminary Analyses

Descriptive statistics. An analysis of demographic variables revealed a significant association between child verbal IQ and several outcome measures. Specifically, children with higher verbal IQ were rated by parents and teachers as having higher rates of EBP ($r = .62$, $p < .001$ and .42, $p = .007$, respectively) and higher parent-rated executive functioning problems

($r = .48, p = .003$). However, children with higher verbal IQs were rated by parents and teachers as being better prepared academically for kindergarten ($r = .52, p = 001$ and $.45, p = .017$, respectively) and performed better on the Bracken, Emotion Knowledge Task, HTKS Task, and AWMA ($r = .62, p < .001$, $r = .47, p = .004$, $r = .54, p = .001$ and $r = .59, p < .001$, respectively). Preliminary analyses did not yield any other significant associations between demographic variables and study outcomes. Given the large correlations between child IQ and a majority of study outcomes, a residual IQ score was derived for each outcome to parcel out the association between IQ and outcomes. Consistent with methods used in prior studies examining outcomes highly correlated with IQ (Rapport et al., 2009), the corresponding residual IQ score was then used as a covariate for each analysis.

Feasibility and Acceptability

Treatment fidelity. Treatment fidelity measures were completed for 32% of camp days with excellent fidelity ($M = 98.09\%$; range = 92%–100%). Fidelity was also completed for 25% of SRPP sessions where the two therapists conducting the SRPP attained excellent fidelity (100%).

Attendance. On average, children attended 95% of the 38 camp days ($M = 36.06, SD = 2.39$) and parents attended 88% of the eight PT sessions ($M = 7.14, SD = .91$).

Treatment satisfaction. After completion of the STP-PreK, parents reported high levels of satisfaction. Parents agreed with statements indicating that their children had benefited ($M = 4.89$ out of 5), that they would recommend the program to another parent ($M = 4.97$ out of 5), and that the program was effective compared with other services they had received ($M = 4.86$ out of 5).

Preliminary Efficacy: School Readiness Outcomes

Behavioral, social-emotional, adaptive outcomes. As can be seen in Table 2, results revealed significant improvements in parent-rated hyperactivity, attention problems, and aggression on the BASC-2. Specifically, parents reported decreased levels of hyperactivity from pre- to posttreatment, $F(1, 31) = 47.30, p < .001, d = -.93$, as well as decreases in attention problems, $F(1, 31) = 24.68, p < .001, d = -1.13$, and aggression $F(1, 31) = 29.16, p < .001, d = -.97$. However, no significant differences in hyperactivity ($p = .360$), inattention ($p = .344$), or aggression ($p = .507$) were reported by teachers at posttreatment.

While no significant improvements were noted in prosocial responding on the CST task ($p = .235$), children significantly improved performance on the emotion knowledge task at posttreatment, $F(1, 27) = 72.50, p < .001, d = 1.96$. Similarly, parents reported increased levels of social skills, $F(1, 27) = 13.83, p = .001, d = .70$, and adaptive skills, $F(1, 27) = 14.32, p = .001, d = .88$, on the BASC-2. No significant differences emerged at posttreatment for teacher-rated social skills ($p = .789$) or adaptive skills ($p = .712$). Follow-up analyses demonstrated that emotion knowledge performance ($d = 3.04, p < .001$) and parent-reported adaptive skills were maintained at follow-up ($d = .82, p = .015$).

Academic outcomes. While no improvements were noted in reading ($p = .146$) or writing performance ($p = .120$), significant improvements were noted for math performance on the WJ-IV, $F(1, 24) = 20.62, p < .001, d = .70$. In addition, parents reported significant improvements in children's academic readiness for kindergarten, $F(1, 24) = 43.58, p < .001, d = 1.17$. However, teachers did not report significant improvements in academic readiness for kindergarten ($p = .243$). Follow-up analyses demonstrated maintenance of improvements in WJ-IV math performance ($d = 1.13$ $p < .001$), WJ writing performance ($d = .56, p = .022$), and parent-rated academic readiness for kindergarten ($d = 1.73, p < .001$).

Table 2. Summary of Behavioral, Social-Emotional, and Adaptive Outcomes.

Measure	Pretreatment[a]	Posttreatment[b]	6-month follow-up[c]	*F* score (pre–post)	*F* score (pre–post-follow-up)	Cohen's *d*
Behavioral functioning						
BASC-2 Hyperactivity (P)	62.17 (.96)	53.49 (1.43)	55.07 (2.61)	47.30***	9.51***	−.93***[ab], −.71†[ac], .15[bc]
BASC-2 Hyperactivity (T)	61.80 (.99)	59.36 (1.95)	—	.88	—	−.32[ab]
BASC-2 Attention Problems (P)	64.17 (1.18)	55.31 (1.50)	60.15 (1.89)	24.68***	11.23***	−1.13***[ab], −.50[ac], .56*[bc]
BASC-2 Attention Problems (T)	59.28 (.47)	57.40 (1.83)	—	.94	—	−.29[ab]
BASC-2 Aggression (P)	52.57 (1.06)	46.60 (1.06)	50.26 (1.88)	29.16***	8.05**	−.97***[ab], −.30[ac], .47[bc]
BASC-2 Aggression (T)	56.56 (1.20)	55.28 (1.74)	—	.46	—	−.17[ab]
Social-emotional and adaptive functioning						
Prosocial Responding CST Task (O)	1.75 (.07)	1.84 (.26)	—	1.48	—	.08[ab]
Emotion Knowledge Task Score (O)	15.59 (.14)	21.41 (.74)	22.39 (.66)	72.50***	89.95***	1.96***[ab], 3.04***[ac], .30[bc]
BASC-2 Social Skills (P)	41.59 (1.49)	48.31 (1.92)	46.00 (1.87)	13.83**	6.07**	.70**[ab], .56[ac], −.26[bc]
BASC-2 Social Skills (T)	43.62 (.90)	44.29 (2.12)	—	.07	—	.09[ab]
BASC-2 Adaptive Skills (P)	40.06 (1.00)	46.88 (1.70)	45.48 (1.72)	14.32**	11.16***	.88**[ab], .82*[ac], −.18[bc]
BASC-2 Adaptive Skills (T)	46.63 (.79)	45.04 (2.30)	—	.14	—	.19[ab]

Note. *p* = parent report measure; T = teacher report measure; O = observational measure; BASC-2 = Behavior Assessment System for Children, 2nd Edition; CST = Challenging Situation Task. Values in parentheses represent standard errors controlling for residualized verbal IQ. Cohen's *d* reported for contrast tests between assessment time points (e.g., ab = comparison of pre- and postassessments). Values represented in tables are derived from separate multivariate models per domain. Teacher outcomes were examined in separate multivariate models per domain.
†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

Self-regulation outcomes: Executive functioning. As can be seen in Table 3, significant improvements were also observed from pre- to posttreatment in executive functioning. Specifically, executive functioning performance on the AWMA, $F(1, 27) = 35.13$, $p < .001$, $d = 1.38$, and the HTKS, $F(1, 27) = 14.52$, $p = .001$, $d = .85$, significantly improved at posttreatment. In addition, parents reported reductions in global executive functioning problems on the BRIEF-P, $F(1, 27) = 50.61$, $p < .001$, $d = -1.73$. Follow-up analyses revealed that HTKS performance not only maintained at follow-up ($d = 1.50$, $p = .001$), but actually continued to improve when compared with posttreatment performance ($d = .86$, $p = .004$). Improvements in parent-rated executive functioning were also maintained at follow-up ($d = -1.00$, $p = .049$).

Self-regulation outcomes: Emotion regulation. Significant improvements were also observed from pre- to posttreatment in parent-rated emotion regulation on the ERC, $F(1, 27) = 14.15$, $p = .001$, $d = .63$.

Discussion

Results of the current study support the initial feasibility and efficacy of the STP-PreK in improving outcomes for preschoolers with ASD and EBP across school readiness outcomes. The program was delivered with high fidelity and was well received by parents, as evidenced by high levels of program attendance and satisfaction. Importantly, participation in the STP-PreK was associated with medium to large improvements across behavioral, social-emotional, adaptive, academic, and self-regulatory domains of school readiness domains.

Consistent with our hypotheses, medium to large improvements were observed in children's behavioral outcomes as evidenced by reductions in parent-rated levels of hyperactivity, attention problems, and aggression. While consistent with previous work documenting the effectiveness of PT programs for improving EBP in children with ASD (Bearss et al., 2015), results also suggest that a behavioral classroom component may be effective in reducing EBP for this population. Specifically, the classroom component implemented a strict behavior management curriculum, which used a token economy and time-out system. Clinical implications suggest that the use of classroom strategies more commonly used for children with EBP may also be efficacious for children with ASD. Indeed, the only significant modification to the STP-PreK for the current study was an increase in staff-student ratio, highlighting the feasibility of using standard treatments across diagnostic groups without significant adaptations.

Results of the current study also demonstrated significant gains in academic outcomes as evidenced not only by parent reports but also by standardized achievement assessments. Past work has demonstrated that behavioral treatments for EBP often fail to generalize gains to academic domains (Kaminski et al., 2008). Contrary to other interventions for EBP, previous examinations of the STP-PreK have documented improvements in academic achievement (Graziano et al., 2014; Graziano & Hart, 2016). Similarly, results of the current study demonstrate that these gains are not limited to children with EBP but are also salient for children with ASD. Improvements in academic outcomes are especially important for this population given the increasing number of children with ASD who require special education services (Newschaffer et al., 2005). Academic gains during the course of a summer intervention may be of additive value as the summer months tend to be marked by significant learning losses (Cooper et al., 2000). This may have significant implications for preschoolers with ASD as they are often underprepared for the kindergarten transition (Forest et al., 2004).

Furthermore, improvements in children's self-regulation were noted after completion of the STP-PreK. Improvements were indexed by parent and teacher reports of executive functioning and emotion regulation as well as performance on a standardized executive functioning battery. Results demonstrate not only the malleability of self-regulation for preschoolers with ASD and

Table 3. Summary of Academic and Self-Regulation Outcomes.

Measure	Pretreatment[a]	Posttreatment[b]	6-month follow-up[c]	*F* score (pre–post)	*F* score (pre–post-follow-up)	Cohen's *d*
Academic functioning						
Bracken School Readiness Composite (SS)	94.20 (.91)	97.20 (1.60)	90.71 (2.69)	3.65†	2.56†	.41$^{\dagger ab}$, −.39^{ac}, −.66$^{\dagger bc}$
WJ Reading Achievement (SS)	100.50 (2.86)	98.63 (2.76)	99.14 (2.71)	2.26	.26	−.12^{ab}, −.11^{ac}, .04^{bc}
WJ Math Achievement (SS)	73.20 (1.48)	80.83 (2.32)	83.62 (2.51)	20.62***	15.82***	.70^{***ab}, 1.13^{***ac}, .26^{bc}
WJ Writing Achievement (SS)	91.50 (1.70)	95.20 (2.15)	97.38 (2.83)	2.60	1.56	.34^{ab}, .56^{*ac}, .19^{bc}
KBACS Academic Readiness (P)	48.50 (2.38)	68.20 (3.56)	71.91 (3.56)	43.58***	27.31***	1.17^{***ab}, 1.73^{***ac}, .23^{bc}
KBACS Academic Readiness (T)	44.40 (2.43)	51.25 (5.27)	—	1.45	—	.33^{ab}
Self-regulation: Executive functioning						
AWMA Total (SS)	82.51 (.35)	90.41 (1.41)	—	35.13***	—	1.38^{***ab}
HTKS Total Score (O)	5.16 (.29)	10.94 (1.70)	21.24 (3.37)	14.52**	14.76***	.85^{**ab}, 1.50^{**ac}, .86^{**bc}
BRIEF Global Executive Function (P)	70.84 (.10)	57.78 (1.92)	62.19 (2.74)	50.61***	11.18***	−1.73^{***ab}, −1.00^{*ac}, .42^{bc}
BRIEF Global Executive Function (T)	68.35 (.30)	64.91 (1.73)	—	3.88†	—	−.59$^{\dagger ab}$
Self-regulation: Emotion regulation						
ERC Regulation Score (P)	3.00 (.07)	3.23 (.06)	3.12 (.09)	14.15**	2.58†	.63^{**ab}, .33^{ac}, −.32^{bc}
ERC Regulation Score (T)	2.65 (.03)	2.88 (.12)	—	3.75†	—	.56$^{\dagger ab}$

Note. *p* = parent report measure; T = teacher report measure; O = observational measure; SS = standardized score; WJ = Woodcock-Johnson Test of Achievement, 4th Edition; KBACS = Kindergarten Behavior and Academic Competency Scale; AWMA = Automated Working Memory Assessment; HTKS = Head-Toes-Knees-Shoulders Task; BRIEF = Behavior Rating Inventory of Executive Function Preschool Version; ERC = Emotion Regulation Checklist. Values in parentheses represent standard errors controlling for residualized verbal IQ. Cohen's *d* reported for contrast tests between assessment time points (e.g., ab = comparison of pre- and postassessments). Values represented in tables are derived from separate multivariate models per domain. Teacher outcomes were examined in separate multivariate models per domain.

$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

EBP but more importantly the initial promise of an existing intervention in improving self-regulation skills. While previous interventions aiming to improve self-regulation in young children have documented mixed findings (Barnett et al., 2008; Diamond et al., 2007), others have been effective in improving self-regulation in typically developing preschoolers (Bierman et al., 2008) and preschoolers with EBP (e.g., STP-PreK, Graziano et al., 2014; Graziano & Hart, 2016). However, this is the first study to our knowledge that has documented improvements in self-regulation for preschoolers with ASD and EBP through a school readiness intervention.

The malleability of self-regulation in young children may be especially important given its implications for school readiness (Ursache et al., 2012). The transition to kindergarten is marked by increased demands and decreased supervision (Rimm-Kaufman & Pianta, 2000), which may be influenced by self-regulation skills. Improvements in self-regulation for young children with ASD are thus vital for a successful transition to kindergarten, which is often challenging for this population (Forest et al., 2004). Clinical implications support the use of classroom strategies, such as circle time games designed to improve self-regulation (Tominey & McClelland, 2011), which were used in the STP-PreK. Findings also support the inclusion of self-regulation content within PT programs for children with ASD and EBP.

Of note, effect sizes across school readiness outcomes were comparable to effect sizes reported in the initial examination of the STP-PreK (Graziano et al., 2014; Graziano & Hart, 2016). Findings highlight the transdiagnostic nature of existing behavioral interventions, such as the STP-PreK, for improving school readiness outcomes among disorders that are often comorbid (e.g., ASD and EBP). Importantly, findings highlight a lack of necessity for significant modifications to existing treatments, as the only adaptation utilized in the current study was an increase in student–staff ratio. Indeed, PT programs for children with EBP have also been effective with little to no adaptations for ASD samples (Bearss et al., 2015). Given the heightened frequency of comorbid ASD and EBP (Gadow et al., 2004; Hartley et al., 2008; Lecavalier, 2006; Mazurek et al., 2013), it is imperative to identify transdiagnostic treatments.

Furthermore, traditional treatments for ASD are often costly (DeFilippis & Wagner, 2016) as most are delivered in individual formats and tend to be lengthy, which contributes to adherence concerns. Within traditional EBP treatments, such as PT, attrition also remains a significant problem (Eyberg et al., 2001; Werba et al., 2006). Notably, excellent adherence to the current treatment was obtained with only two families ($<5\%$) dropping out of treatment. While the current study provides initial promise for a brief multimodal intervention, future work should examine the cost-effectiveness of this approach.

There are several limitations to the current study that should be noted. First, the design (i.e., quasi-experimental) and relatively small sample size precluded us from making more confident conclusions about the efficacy of the STP-PreK in improving school readiness outcomes for the target population. Specifically, given the small sample size, many medium-sized effects were not statistically significant, which was impacted by the low power of the study. For results that were statistically significant with medium to large effect sizes, the role of maturation cannot be fully examined in the absence of a control group. A control group was not included in this study due to limitations surrounding the timing of the intervention. As the STP-PreK is a summer intervention, the appropriateness of a waitlist control group is limited, and due to ethical considerations, a no-treatment group without the possibility of later intervention was not deemed feasible. Nonetheless, substantial evidence exists documenting the stability of behavioral and academic problems for children with ASD if left untreated (Roberts et al., 2003). Future studies should examine the efficacy of this intervention with a larger sample of children with ASD and EBP using a more rigorous (i.e., randomized controlled trial) design.

In addition, it is important to note that most positive effects of the STP-PreK were restricted to parent ratings and observational/structured measures, with limited effects for teacher-rated outcomes. Due to the timing of the intervention, preschool teachers typically

provided pretreatment ratings and kindergarten teachers provided posttreatment ratings for most children. It is not surprising that utilizing different teachers as raters yielded largely null results for teacher-rated outcomes as the behavioral and academic expectations of preschool versus kindergarten teachers may be significantly discrepant. Nonetheless, teacher-reported outcomes are increasingly important within the context of a school readiness intervention and the inability to capture consistent teacher reported gains pose a threat to validity of the current study. Future work is needed to examine the impact of summer interventions on teacher-reported gains utilizing methods that are not limited by discrepant pre- and postraters. Furthermore, parents were not blind to intervention condition and program goals, which may have increased bias in posttreatment ratings. It should be noted that gains reported by parents were corroborated by positive outcomes across observational/structured measures (e.g., EF tasks and emotion knowledge task).

It is important to note that the STP-PreK included a behavioral PT component (i.e., SRPP), which may have implications for child outcomes as PT programs are considered the treatment of choice for improving EBP in young children (Evans et al., 2014; Pelham & Fabiano, 2008). Furthermore, traditional PT programs for EBP have been effective with ASD samples (Bearss et al., 2015). Relatedly, while large effects were documented within the self-regulation domain, the largest effects and most consistent findings for the current study appear to be within the behavioral domain. Improvements in self-regulation domains may also be underscored by improvements in behavioral functioning. It remains unclear the extent to which the PT component may be responsible for improvements in outcomes above and beyond the other STP-PreK classroom-based components. Although this was not tested in the current study, a previous randomized controlled trial of the STP-PreK demonstrated that while participating in the PT component alone yielded improvements in behavioral outcomes, improvements across other domains of school readiness (e.g., academic and self-regulation) were optimal when participating in the intensive summer camp along with the PT program (Graziano et al., 2014; Graziano & Hart, 2016). Results of this study may also suggest that within an ASD sample, participation in the intensive summer camp component yielded optimal results as improvements were observed *across* school readiness domains. Notably, no typically developing children were included in the classroom. Given that the target population in this study represents children who spend at least a portion of time within the mainstream setting, it is important to note that the lack of typically developing peers within the classroom poses a limitation. It will be important for future work to include peers within the context of the STP-PreK, in an effort to more closely mimic the typical classroom environment that children with high-functioning ASD encounter.

Finally, the ethnic homogeneity of the sample is a limitation as more than 70% of families in the sample identified as Hispanic/Latino. However, this limitation may also serve as a strength as Hispanic/Latino children represent the fastest growing and most understudied minority within mental health research (La Greca et al., 2009). Given the rates of later ASD diagnosis in Hispanic/Latino children (Valicenti-McDermott et al., 2012), it is of importance to consider the efficacy of early intervention options available for this population.

In sum, results of the current study provide support for the initial feasibility and efficacy of the STP-PreK in improving school readiness outcomes for preschoolers with ASD and co-occurring EBP. With recent efforts focusing more heavily on complex clinical presentations, the availability of transdiagnostic treatment approaches is becoming increasingly important. While originally developed for children exclusively with EBP, the STP-PreK presents an example of a treatment whose common elements may be effective across diagnostic groups.

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ORCID iD

Rosmary Ros-Demarize https://orcid.org/0000-0003-1155-8627

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