



Multidisciplinary Early Intervention for Preschoolers with Externalizing Behavior Problems and Language Impairment: Results from an Open Trial

Della E. Gregg¹ · Katie C. Hart¹ · Samantha Vaquerano² · Sisan Cuervo¹ · Mildred Suarez^{1,2} · Paulo A. Graziano¹

Accepted: 26 December 2020 / Published online: 1 March 2021

© The Author(s), under exclusive licence to Springer Science+Business Media, LLC part of Springer Nature 2021

Abstract

The purpose of the study was to a) examine school readiness (SR) outcomes in preschoolers with externalizing behavior problems (EBPs) and language impairment (LI) after receiving an intensive multidisciplinary SR intervention and b) examine changes in language as predictors of improvements in SR treatment outcomes via an open trial design. Preschoolers ($n = 91$) with elevated levels of EBPs and comorbid LI ($Mage = 4.77$, $SD = .56$, 76% male, 82% Hispanic/Latino) participated in an 8-week Summer Treatment Program for Pre-Kindergarteners and received speech therapy for 30 min/4 days a week. SR outcomes included language, behavioral, academic, social, and self-regulation measures. Paired sample T-tests revealed significant improvements across SR outcomes. Regression analyses demonstrated that changes in language were associated with changes in academic and executive functioning. Findings indicated that children with comorbid EBPs and LI made significant improvements across SR domains through a multidisciplinary SR intervention. Implications for early intervention for children with EBPs and LI, are discussed.

Keywords Preschoolers · Externalizing behavior problems · Language impairment · School readiness · Early intervention

Externalizing behavior problems (EBPs; e.g., difficulties with hyperactivity, impulsivity, and aggression) are amongst the most prevalent mental health problems in preschoolers (Carbonneau et al. 2016; Egger and Angold 2006) and are associated with significant challenges for children's school readiness (SR) and their transition to kindergarten (Denham 2006; McClelland et al. 2006; Webster-Stratton et al. 2008). Children with EBPs, specifically those with Attention-Deficit Hyperactivity Disorder (ADHD), are approximately five times more likely to have language delays than their typically developing peers (Weiss et al. 2003), with up to 90% of children in clinically referred samples of children with language impairment (LI) having co-occurring ADHD (Mueller and Tomblin 2012). While early intervention efforts have historically targeted these problems separately, it is clear that the scope of these problems requires a multidisciplinary approach.

EBPs and School Readiness

SR is comprised of a host of domains (e.g., language, behavior, academics, social-emotional, and self-regulation) that together qualify whether or not children are “ready” for their transition into the elementary school years (Kagan et al. 1995; Bierman et al. 2008). Preschoolers with EBP's are particularly at-risk for impairment across these SR domains. EBPs present in the preschool years predict later school problems (Angold and Egger 2007), including behavioral difficulties (Campbell and Ewing 1990) and academic underachievement (Masseti et al. 2008). Importantly, SR domains interact and influence one another, which may lead to either positive or negative long-term outcomes. For instance, children who face challenges in learning early literacy and numeracy skills are more likely to be retained in later school years (Justice et al. 2008; Lonigan et al. 2000). Additionally, poor social competence in preschool has been linked to later social difficulties (e.g., deficits in recognizing social cues, peer rejection) at school entry (Denham et al. 2003; Keane and Calkins 2004; Zentall et al. 2001), and later difficulties with academic performance (Eisenberg et al. 2005; McClelland et al. 2000). Moreover, children's self-regulation skills in kindergarten are predictive of later school success, specifically academic

✉ Della E. Gregg
DGREG003@FIU.EDU

¹ Florida International University, Miami, FL, USA

² Speech Pathology and Educational Center Inc., FL Miami, USA

and social functioning (Duncan et al. 2007; Graziano et al. 2007). Poor academic and social functioning has also been implicated in children with language delays in early school years (Hair et al. 2006). As such, targeting SR in early intervention efforts for children with EBPs may relieve long-term negative outcomes associated with these difficulties.

Language Impairment and School Readiness

Language Impairment (LI), as defined by the Individuals with Disabilities and Education Act (IDEA 2004), is a communication disorder that impedes communication, inclusive of expressive and receptive language, that may lead to performance and/or functional deficits in a student's learning environment. Children with LI tend to exhibit functional deficits across school readiness domains. In terms of social functioning, for example, children with LI experience social deficits including limited interactions with peers and less exposure to positive social experiences and feedback from peers (Hart et al. 2004; Vallance et al. 1998). Further, children with language deficits tend to perform poorly on executive functioning (EF) tasks (Im-Bolter and Pascual 2006; Henry et al. 2012) and conversely children with higher language skills are expected to perform better across these tasks. Children who exhibit early language difficulties generally perform significantly lower across measures of school readiness in preschool (Justice et al. 2009). It remains unclear, however, how language skills predict differences in intervention response across distinct SR domains. Longitudinal studies conducted examining long-term outcomes of children with LI have concluded that children whose LI was resolved by 5.5 years of age had good behavioral and social outcomes (Snowling et al. 2006). However, children whose language difficulties persisted through their school years experienced increased risk of challenges with attention, behavioral, and social functioning (Snowling et al. 2006; Conti-Ramsden and Botting 2004). There is also evidence demonstrating that without intervention, LI experienced by young children, not only persists into the early and late school years, but also has long term negative effects on academic functioning in subjects such as reading (Skibbe et al. 2008). Given the long-term effects that early language skills have on SR outcomes, it is important to understand how early intervention targeting language skills may impact intervention response across SR domains.

EBPs and LI

Not surprisingly, there exists a prevalent comorbidity between EBPs and LI (Tirosch and Cohen 1998). Research on the relationship between behavior problems and LI has generally found high rates of EBPs in children with LI (Sanger et al. 2004). Early literature has suggested a higher likelihood of comorbidity between LI and Attention-deficit/hyperactivity

disorder (ADHD) versus LI and speech disorders (Cantwell and Baker 1991) with more recent work confirming high rates of coexisting ADHD and LI (Mueller and Tomblin 2012; Redmond et al. 2015; Tomblin and Mueller 2012). Previous research also suggests that LI and comorbid attention problems lead to more receptive, expressive, and pragmatic language problems (Humphries et al. 1994), with some research demonstrating that preschoolers with comorbid ADHD and expressive LI experience more severe receptive LI when compared to children with ADHD and normal language and children with another psychiatric disorder and LI (Beitchman et al. 1987). Further, children with comorbid ADHD and LI are more likely to present with severe attention problems, as well as, deficits in social cognitive processing (Cohen et al. 1998). Previous work has also linked language deficits and EBPs, specifically ADHD, to academic functioning such that children with ADHD who also present with language problems have poorer academic competence (Sciberras et al. 2014). Overall, there appears to be a reciprocal relationship between EBPs and LI that should be considered in early SR intervention efforts.

Early Intervention to Promote School Readiness for Children with EBPs and LIs

There are a number of interventions that target the domains of SR in young children with EBPs. Behavioral interventions have a long history effective in reducing children's EBPs and increasing behavioral, social-emotional, and academic skills (Evans et al. 2018; Comer et al. 2013). A number of social-emotional interventions [e.g., Preschool PATHS (Kusche and Greenberg 1994); The Incredible Years (Webster-Stratton, 2000)] have also been shown to improve parent-child interactions, promote social-emotional functioning, and reduce behavior problems (Webster-Stratton et al., 2010; Domitrovich et al. 2007). More recently developed early interventions (i.e., Summer Treatment Program for Pre-Kindergarteners (STP-PreK; Graziano and Hart 2016), have been found to improve a number of SR outcomes, including behavioral, academic, and self regulatory skills in young children with EBPs prior to the transition to kindergarten. Fewer interventions target multiple areas of SR in children with LI, such that children with LI typically receive language or learning-based interventions (Bowyer-Crane et al. 2011; Law et al. 2004). Importantly, when EBPs and LI co-occur, early intervention efforts typically address deficits in SR skills in isolation from one another. For example, a child with EBPs and LI may receive services from a psychologist or mental health professional to target domains of behavioral impairment, with some interventions also focused on academic achievement and social-emotional functioning, and then go to a separate clinic to receive services to target the domains of speech and language impairment. In sum, while some SR

skills are being addressed in current interventions for young children with EBPs and LI independently, integrative approaches to early intervention addressing multiple SR deficits associated with EBPs and LI have not been reported in the literature. To our knowledge, this will be the first study to examine SR outcomes in children with EBPs and LI in the context of a multidisciplinary evidence-based intervention program. A multidisciplinary team approach ensures that comprehensive efforts are being made during such a sensitive transitional period. Due to the overlapping impairments associated with EBPs and LI across SR domains, it is important to understand how treating co-occurring symptoms may impact SR skills, and may also allow for better understanding of treatment response in this sample of children.

The Current Study

In summary, deficits across domains of SR have been identified for children with EBPs and LI. Considerably less work has examined SR outcomes for children with EBP's and comorbid LI despite evidence suggesting impairment in SR across these co-occurring disorders in young children. More integrative early intervention approaches may help to improve functioning across SR domains for young children with EBPs and LI, and are necessary to better understand the role of language on SR outcomes for these children.

Therefore, the current study aimed to a) evaluate the promise of a multidisciplinary intensive early intervention approach on SR outcomes in preschoolers with EBPs and LI via an open trial design and b) examine improvements in language as predictors of improvement in SR intervention outcomes. We expected that children with comorbid EBPs and LI would improve across all SR domains. We also hypothesized that more improvement, or change, in language skills would predict more change across SR domains, hypothesizing that change in language could be an indicator of improvements in other intervention outcomes.

Method

Participants and Recruitment

The study was conducted in a large urban university in the Southeast region of the U.S. with a large Hispanic/Latino population. Children and their caregivers were recruited from a variety of different settings including local preschools, referrals from mental health agencies via brochures, radio and newspaper ads, open houses, and parent workshops. The primary caregiver provided written consent prior to the start of the initial screening assessment. To qualify for the study, participants were required to: (a) have an EBP composite t-score of 60 or above on the Behavior Assessment System for

Children, Second Edition (BASC-2; Reynolds and Kamphaus 2004) as reported by their parent or preschool teacher ($M = 62.59$, $SD=11.51$ & $M = 62.30$, $SD=10.05$); (b) be enrolled in preschool during the previous year; (c) have an IQ of 70 or higher ($M=84.11$, $SD=10.76$) based on the Wechsler Preschool and Primary Scale of Intelligence—Fourth edition (WPPSI-IV; Wechsler 2012); (d) have no confirmed history of Autism Spectrum Disorder based on parental report; and (e) be able to attend the daily 8-week summer program (STP PreK; Graziano and Hart 2016) prior to the start of kindergarten. Upon behavioral eligibility completion, children who were currently receiving speech and language services, or for whom there was a concern with speech and language development, were administered the Preschool Language Scale-5 (PLS-5; Zimmerman et al. 2011) to assess current language functioning. Standard scores below 85 on the PLS-5 were considered at-risk for LI and qualified children for services based on best practice recommendations from the Preschool Language Scale-5 and American Speech-Language-Hearing Association (Zimmerman et al. 2011; ASHA 2018).

The final participating sample consisted of 91 preschool children ($M_{age}=4.77$ years, $SD = .55$, 76% male) of predominantly Hispanic/Latino background (82%), with at-risk or clinically elevated levels of EBPs and LI. See Table 1 for sample demographics. Questionnaires were offered in the parents' preferred language across all study assessments. All children were required to be fluent in English as administration of standardized IQ and academic measures could only be conducted in English.

Measures of School Readiness

Language To assess language skills, children were administered the Preschool Language Scale-5 (PLS-5; Zimmerman et al. 2011). This measure was designed for use with children from birth through 7 years of age. The measure is commonly used to assess young children's receptive and expressive language abilities using two standardized subscales, Auditory Comprehension and Expressive Communication. The PLS-5 is a well-established measure, demonstrating high reliability and validity (Zimmerman et al. 2011). The Total Language standard score was used for the current study.

Behavioral Functioning To assess children's externalizing behavior problems, parents completed the Behavior Assessment System for Children-Second Edition (BASC-2; Reynolds and Kamphaus 2004). This measure is commonly used to assess behavioral and emotional domains of functioning. The BASC-2 consists of 134 items, rated on a 4-point scale that measures the frequency in which behaviors occur, ranging from "never" to "almost always". The BASC-2 is a well-established measure, consisting of high

Table 1 Demographics for Sample

Characteristic	Percentage in sample	<i>n</i>
Child race/ethnicity		
Non-Hispanic/Latino White	14	13
African American	3	3
Hispanic/Latino	82	75
Parent race/ethnicity		
Non-Hispanic/Latino White	10	7
African American	4	3
Hispanic/Latino	85	62
Other	1	1
Parent primary language		
English	63	46
Spanish	18	13
Did not report	19	19
Family marital status		
Intact two parent household	51	37
Living with a partner	11	8
Single-parent household-divorced/separated	22	16
Single-parent household-never married	16	12
Maternal education		
Some high school	3	2
High school graduate	7	5
Some college or associates degree	36	26
Bachelor's degree	27	20
Graduate degree	27	20
Reporter of questionnaires		
Mothers	81	73
Fathers	19	17
Other	1	1

internal consistency, reliability and validity (Doyle et al. 1997; Reynolds and Kamphaus 1992). The gender and age normed broad externalizing composite t-scores ($\alpha = .89-.91$) which is composed of items across hyperactivity, attention problems, and aggression subscales were examined in this study. To assess children's behavioral impairment, parents completed the Impairment Rating Scale (IRS; Fabiano et al. 2006). The IRS measures severity of behavior problems across multiple domains including academic, classroom, self-esteem, peer, teacher, and overall functioning. The IRS consists of 8 items rated on a 7-point scale that ranges from 0 (no impairment) to 6 (extreme impairment). The IRS demonstrates high internal consistency and convergent validity with other assessments of impairment (Fabiano et al. 2006). The item assessing overall functioning was used to examine behavioral impairment across settings.

Academic Functioning Children were administered the Bracken School Readiness Assessment (BSRA; Bracken 2002) to assesses receptive knowledge of colors, letters, numbers/counting, size/comparison, and shapes. The BSRA has been well validated as a strong predictor of children's academic outcomes (Bracken 2002; Panter and Bracken 2009). For the purposes of this study, the overall school readiness standard score was used. Children were also administered the Woodcock–Johnson Test of Achievement, 3rd Edition (WJ-III ACH, Woodcock et al. 2001), a norm-referenced assessment of academic achievement with strong psychometric properties (Cizek 2003; Sandoval and Morrison 2003). The six subtests administered included letter-word identification, applied problems, calculation, passage comprehension, spelling, and writing samples. The current study examined the overall achievement composite of the six subscales described above.

Social Functioning Parents rated children's social functioning on the social skills subscale of the BASC-2 (Reynolds and Kamphaus 2004). The social skills scale of the BASC-2 includes questions such as “begins conversations appropriately” and “offers help to other children.” This subscale has good convergent validity with other social functioning measures such as the Social Skills Rating System (SSRS; Flanagan et al. 1996). The gender and age normed social skills t-scores ($\alpha = .77-.88$) were examined in this study.

Emotion Regulation To assess children's emotional functioning, parents completed the Emotion Regulation Checklist (ERC; Shields and Cicchetti 1997). The ERC is a 24-item measure that is comprised of two scales (Emotion Regulation and Negativity/Lability). The Emotion Regulation scale measures processes that play a role in regulation, and Negativity/Lability measures lability of mood and negative affect. The ERC measures parents' perception of their child's emotional functioning on a scale of 1 to 4 (never, sometimes, often, always). Previous work has demonstrated high internal consistency for the Negativity/Lability scale = .96 and for the Emotion Regulation scale = .83, as well as a significant negative correlation between the two subscales ($r = -.50, p < .001$; Shields and Cicchetti 1997). The Emotion Regulation scale (α 's = .65-.68) was used for the purpose of this study.

Executive Functioning Children were administered the Head-Toes-Knees-Shoulders task (HTKS; Ponitz et al. 2008). The HTKS is a widely-used task used with preschoolers to assess executive functioning. In this task children are given two paired behavioral rules in two parts (e.g., “touch your head” and “touch your toes” in the first part and “touch your knees” and “touch your shoulders” in the second part) in which they demonstrate where each body part is located on their body.

Next, children are instructed to switch and respond in opposite ways (e.g., “Touch your toes,” requires a correct response for touching their head) that eventually require them to combine both sets of rules (head and toes versus knees and shoulders) for four different response options. Children score two points for a correct response, zero points for an incorrect response, and one point for self-corrected responses. Scores ranged from 0 to 40, with higher scores being indicative of better EF.

Procedures

This study was approved by the university’s institutional review board (IRB). An open trial design was used to determine the promise of the intervention on improving SR outcomes in preschoolers with EBPs and LI. All families took part in a pre-treatment assessment, conducted prior to start of intervention, in which parents were asked to fill out questionnaires about their child’s SR, as well as, complete a background and diagnostic interview with trained clinicians. Children were administered intellectual (WPPSI-IV), academic achievement (WJ-III), school readiness (BSRA), and executive functioning (HTKS) assessments. If parents reported concerns with speech and language, children were referred to the program’s bilingual speech-language pathologist (SLP) team for a language screener, also conducted prior to the start of intervention. The screener involved determining if the child had a receptive and/or expressive language delay through administration of the PLS-5. All participants were dominant English speakers based on language testing. Families also participated in a post-treatment assessment following the completion of the summer intervention, which included parent questionnaires of SR skills and assessments of child academic achievement, school readiness, language skills, and executive functioning. All post-treatment assessments were completed within two weeks of intervention completion.

All participants were enrolled in the STP-PreK, a comprehensive school readiness program for preschool children with EBPs that prepares both participating children and their families for the transition to kindergarten (STP-PreK; Graziano and Hart 2016). Every classroom was comprised of 14–16 children with a lead certified teacher, lead behavioral counselor, four supporting paraprofessional counselors, and a speech/language trainee, yielding a staff to student ratio of about 1:2. All staff underwent a comprehensive 10-day training involving behavior modification for child behavior problems with mastery required (80%) on a procedural test of the STP-PreK manual and were supervised by two licensed psychologists and an American Speech–Language–Hearing Association (ASHA) certified speech–language pathologist (SLP). Children participated in academic, recreational, social-emotional and self-regulation activities. The program incorporates a behavior modification system adapted from the evidence-based system used in the Children’s Summer

Treatment Program Academic Learning Centers (Pelham Jr and Fabiano 2008). Parents received daily written feedback about children’s behavior and academic progress in the form of a daily report card (DRC) and were instructed on how to provide home-based rewards. Parents were also required to attend a School Readiness Parenting Program (SRPP; Graziano et al. 2018) that was conducted weekly lasting between 1.5 and 2 hours. A detailed description of the academic, behavioral, social-emotional, self-regulation, and parenting components, as well as the feasibility and initial efficacy of this program, in improving school readiness outcomes on those domains is reported elsewhere (Graziano et al. 2014; Graziano and Hart 2016; Graziano et al. 2018).

Speech and language services were provided by SLP graduate students under the direct supervision of an ASHA certified SLP within the context of STP-PreK. Children received speech-language services four times a week for 30-minute sessions employing a combined push-in and pull-out model (ASHA 2018), in addition to attendance in STP-PreK the remainder of the day. Pull-out sessions consisted of traditional individual therapy sessions that provided the child with structured opportunities to meet their language goals, which varied based on their language abilities. Push-in sessions allowed for generalization of skills within the child’s natural environment in the classroom, which provided little disruption to the child’s class routine and facilitated communication with same-aged peers. As a result of the push-in sessions, increased opportunities for appropriate language modeling of goals were provided for peer-to-peer verbal exchanges and peer to counselor verbalizations. Parents received weekly feedback on language goals and the percentage of goals met per week during program dismissal time. The SLP reviewed the evaluation results and plans of care with parents during the first weekly feedback session. Subsequent weeks consisted of reviewing progress notes regarding child goals. Weekly thematic bulletins were provided to parents of all children in the intervention program including children receiving language services to enhance language enrichment opportunities between caregivers and children. Further, the SLP team received weekly clinical supervision alongside the behavioral and academic team to discuss common goals in an integrative manner. As previously mentioned, intensive training provided to all staff also involved the SLP team training behavioral counselors on how to actively promote speech/language development through counselor interactions.

With respect to attendance in intervention, children in this subset of the total sample attended an average of 90% of program days ($SD = 5.13$). Parents of children in this subset also attended an average of 90% of weekly parent training ($SD = 1.01$).

Data Analytic Plan

All analyses were conducted using the Statistical Package for Social Sciences, version 20 (SPSS 20). There was less than 6% of missing data for any study variables at pre-treatment and post-treatment. The primary reason for missing data included missing items on rating scales. According to Little's Missing Completely at Random test, the data were missing completely at random ($\chi^2 = 20.94, p > .05$). Preliminary data analyses were conducted to examine any associations between demographic variables and any outcome variables used in the current study. Utilizing an open trial design, paired sample T-tests were conducted to analyze mean differences pre- to post-treatment on SR outcomes (i.e., language, behavioral, academic, social, and self-regulatory functioning). Cohen's *d* effect size estimates ([pre-treatment–post-treatment assessment]/ pooled SD) were provided for all analyses. Multiple linear regressions were then employed to investigate the extent to which change in language outcomes predict improvements in the dependent variables of interest (i.e., behavior, academic, social, and self-regulation outcomes) after controlling for baseline language and SR skills. Covariates in the model included age, gender, full scale IQ, and pre-treatment language and SR skills.

Results

Preliminary Analyses

Analyses of demographic variables revealed significant associations (see Tables 3 and 4) between demographic variables (i.e., child age, sex, and IQ) and parent reported social skills, BSRA scores, WJ-III achievement scores, and HTKS scores. Thus, demographic variables were only entered as covariates in subsequent analyses for these variables, but not for parent-reported impairment of EBP's and ER.

Promise of Intervention on School Readiness Outcomes

As seen in Table 2, paired sample T-tests revealed that children significantly improved across all school readiness outcomes with small to large effect sizes. With respect to language skills, children significantly improved, ($t(90) = 16.25, p < .001, d = 1.1$), from pre to post. For behavioral outcomes, there were significant reductions in EBP's, ($t(84) = 10.21, p < .001, d = 1.29$), and behavioral impairment on the IRS, ($t(86) = 7.29, p < .001, d = 0.98$), from pre to post. Academic skills across both the BSRA-3, ($t(90) = -2.35, p = .03, d = 0.14$), and WJ-IV significantly increased, ($t(90) = -4.25, p < .001, d = 0.32$), from pre to post. There were statistically significant improvements in social skills ($t(84) = -6.67, p < .001, d =$

0.69), from pre to post. In regard to self-regulation, ER ($t(87) = -5.49, p < .001, d = 0.64$), as well as EF, ($t(88) = -8.34, p < .001, d = 1.04$), significantly improved from pre to post.

Impact of Language Improvements on Improvements in School Readiness Outcomes

Separate regression analyses were conducted to determine the effect of change in language symptoms on SR measures (i.e., EBPs, academic functioning based on the BSRA and WJ-III ACH overall achievement, social skills, ER, and EF). Covariates including full scale IQ, gender, and age were entered on the first step, and post-treatment scores across SR outcomes were entered on the second step to examine the unique effect of change in language after accounting for baseline levels of language and each respective SR skill.

As seen in Table 3, improvements in language significantly predicted improvements in overall academic achievement ($\beta = .25, p < .05$), after accounting for full scale IQ, gender, and baseline language and academic skills, suggesting that children with improvements in language skills tended to have more intervention gains in their academic achievement. However, improvements in language were not related to improvements in EBPs ($\beta = .02, p = .87$), overall behavioral impairment ($\beta = .001, p = .98$) or academic skills via the BSRA ($\beta = -2.28, p = .13$). As seen in Table 4, improvements in language significantly predicted improvements in executive functioning ($\beta = .32, p < .05$), after accounting for full scale IQ, age, and baseline language and EF skills, suggesting that children's improvements in language skills was associated with improvements in their EF skills. There was no significant effect on improvements in ER ($\beta = .004, p > .05$) or social skills ($\beta = .22, p > .05$).

Discussion

The purpose of the current study was to evaluate the promise of a multidisciplinary intensive early intervention approach on SR outcomes in preschoolers with EBPs and LI.

Consistent with our hypothesis, findings revealed improvements with small to large effect sizes across language, behavioral, academic, social, and self-regulatory school readiness outcomes. The findings of this study are consistent with previous studies of the STP-PreK program (i.e., Graziano et al. 2014; Graziano and Hart 2016; Graziano et al. 2018) reporting improvements across multiple domains of SR in children with EBPs as reported by parents and observational/standardized assessments. Unique to the current study is the inclusion of language measures, indicating that children's language skills significantly improved over the course of intervention. Providing speech and language supports within the context

Table 2 School Readiness Outcomes

	Pre-treatment		Post-treatment			Pre-treatment	Post-treatment			
	M	SD	M	SD	n	95% CI for Mean Difference		t	df	d
Language										
PLS-5 Auditory Comprehension (O)	83.24	10.99	96.6	12.79	91	80.99,85.46	94.01,99.18	−15.85***	90	1.12
PLS-5 Expressive Language (O)	76.03	10.23	87.68	13.22	91	73.88,78.14	85.02,90.31	−13.14***	90	0.99
PLS-5 Total Language (O)	78.62	10.41	91.58	13.1	91	76.57,80.80	88.98,94.40	−16.24***	90	1.10
Behavior										
BASC-2 EBP (P)	62.51	11.78	48.69	9.49	85	59.95,65.26	46.78,50.72	10.21***	84	1.29
IRS Overall Functioning	4.36	1.17	2.95	1.67	87	4.06,4.56	2.60,3.31	7.29***	86	0.98
Academics										
Bracken SRC Total (O)	94.89	13.53	96.78	14.18	91	92.07,97.71	93.82,99.73	−2.35*	90	0.14
WJ-III Overall Achievement (O)	93.82	12.99	97.95	12.89	91	92.24,97.25	95.59,100.87	−4.25***	90	0.32
Social										
BASC-2 SS (P)	47.18	10.18	54.33	10.62	85	42.98,49.15	52.01,56.40	−6.67***	84	0.69
Self-Regulation										
HTKS Total Score (O)	5.58	7.57	18.55	15.94	89	4.01,7.35	15.33,21.85	−8.34***	88	1.04
ERC Emotion Regulation Total (P)	3.18	0.41	3.44	0.4	88	3.11,3.27	3.35,3.52	−5.49***	87	0.64

Note. *** $p < .001$, * $p < .05$ WJ = Woodcock Johnson Test of Achievement, 3rd Edition, BASC = Behavior Assessment System for Children, 2nd Edition, IRS = Impairment Rating Scale, PLS-5 = Preschool Language Scale, 5th Edition, HTKS = Head-Toes-Knees-Shoulders Task, ERC = Emotion Regulation Checklist, EBP = Externalizing Behavior Problems, SRC = School Readiness Composite, SS = Social Skills, O = observed or clinician administered measure, P = parent report measure

of a school readiness intervention program and integrating disciplines to address co-occurring deficits appears to be a promising direction for early intervention efforts. It is particularly encouraging to see similar patterns of improvement in children's behavioral, social-emotional, self-regulatory, and academic skills, as we do for children with EBPs without LI. This is particularly important, especially when considering multiple impairments associated with children who present with both EBPs and LI. Additionally, there is literature proposing that the development of LI is due to processing deficits associated with EF (Leonard et al. 2007). Therefore, given the significant improvements seen in EF skills, specifically targeting EF skills in the context of a multidisciplinary intervention for children with EBPs and LI, both of which may exhibit EF deficits, appears to be a promising intervention component for these children. Overall, these findings highlight the efficacy of a SR intervention approach for early intervention in young children with EBPs and LI.

Concurrent with our second hypothesis, improvements in language were predictive of improvements in academic achievement and EF. These results suggest that pre- to post-intervention change in the aforementioned domains may be influenced by pre- to post-intervention improvements in language. This finding highlights the importance of targeting language skills in intervention for children with comorbid EBPs and LI, especially given its impact on change in

academic achievement and EF. However, improvements in language were not predictive of improvements in behavior, BSRA, social skills, and ER. We hypothesize that changes in language were not predictive of changes in behavioral functioning because of the potential bidirectional nature between behavior and language (Hartas 2012), such that, improvements in behavior may be the driving force in predicting improvements in language and not the other way around. We also hypothesize that improvements in language were not predictive of improvements on the BSRA because the majority of children in this sample were within the average range on the BSRA prior to intervention. Therefore, there was limited room for growth in academics via the BSRA compared to other subdomains of SR. Similarly, improvements in language were not predictive of improvements in ER, possibly due to parents' limited endorsement of emotion dysregulation.

Of clinical relevance, improvements in EF due to improvements in language may be due to associations between belonging to a culturally diverse background (e.g., Hispanic/Latino), which may allow for dual language exposure, with some research supporting that dual language exposure results in stronger development of EF skills (Adesope et al. 2010; Morales et al. 2013; Lonigan et al. 2016; Garcia et al. 2018). There is also considerable work suggesting that EF is more closely associated with LI than with ADHD (Cohen et al. 2000) and that working memory (an element of EF) is

Table 3 Model for Improvements in Language Predicting Improvements in Behavioral and Academic Outcomes

	b	p	t	Model R ²	ΔR ²	ΔF (p)
Behavior: Post EBP (BASC-2)						
Step 1. Full Scale IQ (WPPSI-IV)	0.02	0.87	0.17	0.11	0.11	3.27*(.03)
Baseline EBP (BASC-2)	0.26	0.003	3.05	—	—	—
Baseline Total Language (PLS-5)	−0.03	0.8	3.05	—	—	—
Step 2. Post Total Language (PLS-5)	−0.21	0.14	−1.48	0.13	0.02	2.18(.14)
Behavior: Post Overall Impairment (IRS)						
Step 1. Full Scale IQ (WPPSI-IV)	0.001	0.98	−0.02	0.06	0.06	1.73(.17)
Baseline Overall Impairment (IRS)	0.34	0.03	2.25	—	—	—
Baseline Total Language (PLS-5)	−0.005	0.83	−0.22	—	—	—
Step 2. Post Total Language (PLS-5)	−0.03	0.24	−1.17	0.07	0.02	1.37(.24)
Academics: Post Bracken SRC (BSRA)						
Step 1. Child age	−2.28	0.13	−1.54	0.75	0.75	65.30***(.001)
Full Scale IQ (WPPSI-IV)	0.11	0.26	1.13	—	—	—
Baseline Bracken SRC (BSRA)	0.74	0.001	10.1	—	—	—
Baseline Total Language (PLS-5)	0.2	0.03	2.15	—	—	—
Step 2. Post Total Language (PLS-5)	0.12	0.27	1.11	0.76	0.004	1.24(.27)
Academics: Post Overall Achievement (WJ-III)						
Step 1. Child age	−5.15	0.001	−1.33	0.65	0.65	31.16***(.001)
Child sex	−3.93	0.05	−2.11	—	—	—
Full Scale IQ (WPPSI-IV)	−0.13	0.19	−1.33	—	—	—
Baseline Overall Achievement (WJ-III)	0.65	0.001	8.62	—	—	—
Baseline Total Language (PLS-5)	0.2	0.05	1.97	—	—	—
Step 2. Post Total Language (PLS-5)	0.25	0.03	2.2	0.67	0.02	4.84*(.03)

Note. *** $p < .001$, * $p < .05$. WJ-III = Woodcock Johnson Test of Achievement, 3rd Edition, BASC = Behavior Assessment System for Children, 2nd Edition, IRS = Impairment Rating Scale, PLS = Preschool Language Scale, HTKS= Head-Toes-Knees-Shoulders Task, ERC = Emotion Regulation Checklist, EBP= Externalizing Behavior Problems, SRC= School Readiness Composite, IQ = Intelligence Quotient, WPPSI-IV = Wechsler Preschool and Primary Scale of Intelligence, Fourth Edition

language based (Denckla 1996). Therefore, associations between language and EF are consistent with previous literature.

Limitations and Future Directions

There are limitations to the current study that should be noted. An important limitation to consider is the lack of a control group. Therefore, threats to validity, such as regression to the mean, may be influencing our findings. Inclusion of change scores, however, may improve reliability of our findings. Future studies should examine the effects of a randomized-controlled trial (RCT), to support our current findings and enhance the efficacy of our multidisciplinary SR intervention program. For example, it would be crucial to establish whether providing the STP-PreK alone, without speech services, would yield similar benefits to children with comorbid EBPs and LI compared to the combined STP-PreK and speech therapy approach.

An additional limitation to consider is the homogeneity of the sample used in the current study. Although the sample size

was large ($n=91$), the majority of participants were male (76%), and identified as Hispanic/Latino (82%), therefore limiting the generalizability of our conclusions to more heterogeneous groups. However, it has been demonstrated that males are at higher risk for EBP's (Biederman et al. 2002) and LIs (Shriberg et al. 1999); therefore our sample is representative of samples in clinical practice. This limitation may also serve as a strength, as Hispanic/Latino children represent the fastest growing group in the U.S. and are the most understudied ethnic minority group in mental health research (La Greca et al. 2009).

With regard to future directions, it would be of interest to replicate these findings within other populations with comorbid language and speech deficits. For instance, children with social communication deficits such as ASD also present with high levels of language impairment (Loucas et al. 2008), which may also be contributing to overall impairment across SR domains. Given the high rates of comorbidity of EBPs and LI with learning disorders (Grizzle and Simms 2009; Mayes et al. 2000), it would also be of interest to examine the efficacy

Table 4 Model for Improvements in Language Predicting Improvements in Social and Self-Regulation Outcomes

	b	p	t	Model R ²	ΔR ²	ΔF (p)
Social: Post Social Skills (BASC-2)						
Step 1. Child sex	−2.18	0.37	−0.91	0.34	0.34	10.18***(.001)
Full Scale IQ (WPPSI-IV)	0.03	0.82	0.23	—	—	—
Baseline Social Skills (BASC-2)	0.52	0.001	5.08	—	—	—
Baseline Total Language (PLS-5)	0.15	0.19	1.32	—	—	—
Step 2. Post Total Language (PLS-5)	0.23	0.11	1.63	0.36	0.02	2.65(.11)
Self-Regulation: Post EF (HTKS)						
Step 1. Child age	5.3	0.006	2.81	0.4	0.4	14.52***(.001)
Full Scale IQ (WPPSI-IV)	0.31	0.01	2.63	—	—	—
Baseline EF (HTKS)	0.51	0.001	3.33	—	—	—
Baseline Total Language (PLS-5)	0.31	0.02	2.49	—	—	—
Step 2. Post Total Language (PLS-5)	0.32	0.03	2.26	0.44	0.03	5.09*(.03)
Self-Regulation: Post ER (ERC)						
Step 1. Full Scale IQ (WPPSI-IV)	−0.001	0.79	−0.27	0.18	0.18	6.15***(.001)
Baseline ER (ERC)	0.42	0.001	4.28	—	—	—
Baseline Total Language (PLS-5)	0.001	0.95	0.06	—	—	—
Step 2. Post Total Language (PLS-5)	0.004	0.47	0.72	0.19	0.005	.52(.47)

Note *** $p < .001$, * $p < .05$ WJ-III = Woodcock Johnson Test of Achievement, 3rd Edition, BASC = Behavior Assessment System for Children, 2nd Edition, IRS = Impairment Rating Scale, PLS = Preschool Language Scale, HTKS = Head-Toes-Knees-Shoulders Task, ERC = Emotion Regulation Checklist, IQ = Intelligence Quotient, WPPSI-IV = Wechsler Preschool and Primary Scale of Intelligence, Fourth Edition. EF = Executive Functioning, ER = Emotion Regulation

of our SR intervention approach with young children who also have learning difficulties.

With regard to clinical implications of the current study, results highlight the promise of providing integrated speech services into a school readiness intervention for children with EBP's and comorbid LI. Although behavioral interventions are effective in improving SR outcomes for children with EBPs, it is likely that a portion of children with comorbid conditions experience varying treatment response (Law et al. 2004) and therefore may benefit from multidisciplinary intervention approaches. Incorporating multidisciplinary team approaches with children who exhibit comorbid symptomatology ensures that comprehensive efforts are being made during a sensitive transitional period, when early intervention is key.

Future studies should examine treatment factors, specifically between language and academic functioning that may contribute to improving outcomes for children with comorbid LI. The results of the current study emphasize the potential utility of a multidisciplinary early intervention program, which may address common barriers to accessing high-quality services and may result in long-term cost-savings. For example, for families of children with EBP and LI, it is common for parents to have to see multiple treatment providers to meet behavioral, academic, and language needs of their child. Typically, there is not a one-stop shop. Although children may receive some services in school, often time parents have to coordinate appointments across service providers, which involves a

tremendous amount of time, money, and effort. However, taking a more comprehensive care approach may reduce practical barriers that many families encounter in this process. Thus, future studies should evaluate the cost effectiveness of this early intervention program, especially given previous research indicating that language deficits resolved by 5.5 years lead to better long-term benefits (Snowling et al. 2006). Finally, our findings capitalize on the utility of providing services during the summer, when we have a unique opportunity to impact children's SR skills, and when they might not otherwise not be receiving supports in school or other childcare environments.

In summary, results of the current study support the promise of incorporating speech services in an early intervention program that targets SR domains (i.e., language, behavior, academics, social, and self-regulation) for preschoolers with EBPs and LI. Importantly, results suggest the viable impact that improvements in language skills may have across SR intervention outcomes. While the current study provides initial insight into the role of language as a predictor of SR outcomes for children with EBPs and LI, more work is needed in further understanding the mechanisms by which language functioning impacts domains of SR.

Acknowledgements The research reported here was supported by the Institute of Education Sciences, U.S. Department of Education, through Grant R324A120136, and The Children's Trust. The opinions expressed

are those of the authors and do not represent the views of the Institute, the U.S. Department of Education, or The Children's Trust. The authors would like to thank the families who participated in the study and the students and staff that made the program possible.

References

- Adesope, O. O., Lavin, T., Thompson, T., & Ungerleider, C. (2010). A systematic review and meta-analysis of the cognitive correlates of bilingualism. *Review of Educational Research*, 80(2), 207–245.
- Angold, A., & Egger, H. L. (2007). Preschool psychopathology: lessons for the lifespan. *Journal of Child Psychology and Psychiatry*, 48(10), 961–966.
- ASHA (2018). Types of Services. Retrieved March 29, 2018, <https://www.asha.org/NJC/Types-of-Services/>
- Beitchman, J., Tuckett, M., & Bath, S. (1987). Language delay and hyperactivity in preschoolers: Evidence for a distinct subgroup of hyperactives. *Canadian Journal of Psychiatry*, 32(8), 683–687.
- Biederman, J., Mick, E., Faraone, S. V., Braaten, E., Doyle, A., Spencer, T., et al. (2002). Influence of gender on attention deficit hyperactivity disorder in children referred to a psychiatric clinic. *American Journal of Psychiatry*, 159(1), 36–42.
- Bierman, K. L., Domitrovich, C. E., Nix, R. L., Gest, S. D., Welsh, J. A., Greenberg, M. T., & Gill, S. (2008). Promoting academic and social-emotional school readiness: The Head Start REDI program. *Child Development*, 79(6), 1802–1817.
- Bowyer-Crane, C., Snowling, M. J., Duff, F., & Hulme, C. (2011). Response to Early Intervention of Children with Specific and General Language Impairment. *Learning Disabilities: A Contemporary Journal*, 9(2), 107–121.
- BRACKEN, B. (2002). Manual Bracken School Readiness Assessment.
- Campbell, S. B., & Ewing, L. J. (1990). Follow-up of hard-to-manage preschoolers: adjustment at age 9 and predictors of continuing symptoms. *Journal of Child Psychology and Psychiatry*, 31(6), 871–889.
- Cantwell, D. P., & Baker, L. (Eds.). (1991). *Psychiatric and developmental disorders in children with communication disorder*. Amer Psychiatric Pub Incorporated.
- Carbonneau, R., Boivin, M., Brendgen, M., Nagin, D., & Tremblay, R. E. (2016). Comorbid development of disruptive behaviors from age 1½ to 5 years in a population birth-cohort and association with school adjustment in first grade. *Journal of Abnormal Child Psychology*, 44(4), 677–690.
- Cizek, G. J. (2003). *Detecting and preventing classroom cheating: Promoting integrity in assessment*. Corwin Press.
- Cohen, N. J., Menna, R., Vallance, D. D., Barwick, M. A., Im, N., & Horodezky, N. B. (1998). Language, social cognitive processing, and behavioral characteristics of psychiatrically disturbed children with previously identified and unsuspected language impairments. *The Journal of Child Psychology and Psychiatry and Allied Disciplines*, 39(6), 853–864.
- Cohen, N. J., Vallance, D. D., Barwick, M., Im, N., Menna, R., Horodezky, N. B., & Isaacson, L. (2000). The interface between ADHD and language impairment: An examination of language, achievement, and cognitive processing. *The Journal of Child Psychology and Psychiatry and Allied Disciplines*, 41(3), 353–362.
- Comer, J. S., Chow, C., Chan, P. T., Cooper-Vince, C., & Wilson, L. A. (2013). Psychosocial treatment efficacy for disruptive behavior problems in very young children: A meta-analytic examination. *Journal of the American Academy of Child and Adolescent Psychiatry*, 52(1), 26–36.
- Conti-Ramsden, G., & Botting, N. (2004). Social difficulties and victimization in children with SLI at 11 years of age. *Journal of Speech, Language, and Hearing Research*.
- Denckla, M. B. (1996). A theory and model of executive function: A neuropsychological perspective.
- Denham, S. A. (2006). Social-emotional competence as support for school readiness: What is it and how do we assess it? *Early Education and Development*, 17(1), 57–89.
- Denham, S. A., Blair, K. A., DeMulder, E., Levitas, J., Sawyer, K., Auerbach-Major, S., & Queenan, P. (2003). Preschool emotional competence: Pathway to social competence? *Child Development*, 74(1), 238–256.
- Domitrovich, C. E., Cortes, R. C., & Greenberg, M. T. (2007). Improving young children's social and emotional competence: A randomized trial of the preschool "PATHS" curriculum. *The Journal of Primary Prevention*, 28(2), 67–91.
- Doyle, A., Ostrander, R., Skare, S., Crosby, R. D., & August, G. J. (1997). Convergent and criterion-related validity of the behavior assessment system for children-parent rating scale. *Journal of Clinical Child Psychology*, 26(3), 276–284.
- Duncan, G. J., Dowsett, C. J., Claessens, A., Magnuson, K., Huston, A. C., Klebanov, P., & Sexton, H. (2007). School readiness and later achievement. *Developmental Psychology*, 43(6), 1428.
- Egger, H. L., & Angold, A. (2006). Common emotional and behavioral disorders in preschool children: presentation, nosology, and epidemiology. *Journal of Child Psychology and Psychiatry*, 47(3–4), 313–337.
- Eisenberg, N., Sadovsky, A., Spinrad, T. L., Fabes, R. A., Losoya, S. H., Valiente, C., et al. (2005). The relations of problem behavior status to children's negative emotionality, effortful control, and impulsivity: concurrent relations and prediction of change. *Developmental Psychology*, 41(1), 193.
- Evans, S. W., Owens, J. S., Wymbs, B. T., & Ray, A. R. (2018). Evidence-based psychosocial treatments for children and adolescents with attention deficit/hyperactivity disorder. *Journal of Clinical Child and Adolescent Psychology*, 47(2), 157–198.
- Fabiano, G. A., Pelham Jr., W. E., Waschbusch, D. A., Gnagy, E. M., Lahey, B. B., Chronis, A. M., et al. (2006). A practical measure of impairment: Psychometric properties of the impairment rating scale in samples of children with attention deficit hyperactivity disorder and two school-based samples. *Journal of Clinical Child and Adolescent Psychology*, 35, 369–385.
- Flanagan, D. P., Alfonso, V. C., Primavera, L. H., Povall, L., & Higgins, D. (1996). Convergent validity of the BASC and SSRS: Implications for social skills assessment. *Psychology in the Schools*, 33(1), 13–23.
- Garcia, A. M., Ros, R., Hart, K. C., & Graziano, P. A. (2018). Comparing working memory in bilingual and monolingual Hispanic/Latino preschoolers with disruptive behavior disorders. *Journal of Experimental Child Psychology*, 166, 535–548.
- Graziano, P. A., & Hart, K. (2016). Beyond behavior modification: benefits of social-emotional/self-regulation training for preschoolers with behavior problems. *Journal of School Psychology*, 58, 91–111.
- Graziano, P. A., Reavis, R. D., Keane, S. P., & Calkins, S. D. (2007). The role of emotion regulation in children's early academic success. *Journal of School Psychology*, 45(1), 3–19.
- Graziano, P. A., Slavec, J., Hart, K., Garcia, A., & Pelham, W. E. (2014). Improving school readiness in preschoolers with behavior problems: Results from a summer treatment program. *Journal of Psychopathology and Behavioral Assessment*, 36(4), 555–569.
- Graziano, P. A., Ros, R., Hart, K. C., & Slavec, J. (2018). Summer treatment program for preschoolers with externalizing behavior problems: A preliminary examination of parenting outcomes. *Journal of Abnormal Child Psychology*, 46(6), 1253–1265.
- Grizzle, K. L., & Simms, M. D. (2009). Language and learning: a discussion of typical and disordered development. *Current Problems in Pediatric and Adolescent Health Care*, 39(7), 168.
- Hair, E., Halle, T., Terry-Humen, E., Lavelle, B., & Calkins, J. (2006). Children's school readiness in the ECLS-K: Predictions to academic,

- health, and social outcomes in first grade. *Early Child Research Quarterly*, 21(4), 431–454.
- Hart, K. I., Fujiki, M., Brinton, B., & Hart, C. H. (2004). *The relationship between social behavior and severity of language impairment*. Journal of Speech: Language, and Hearing Research.
- Hartas, D. (2012). Children's social behaviour, language and literacy in early years. *Oxford Review of Education*, 38(3), 357–376.
- Henry, L. A., Messer, D. J., & Nash, G. (2012). Executive functioning in children with specific language impairment. *Journal of Child Psychology and Psychiatry*, 53(1), 37–45.
- Humphries, T., Koltun, H., Malone, M., & Roberts, W. (1994). Teacher-identified oral language difficulties among boys with attentional problems. *Journal of Developmental and Behavioral Pediatrics*.
- Im-Bolter, J., & Pascual L. (2006). Processing limitations in children with specific language impairment: The role of executive function. *Child Development*, 77(6), 1822–1841.
- Individuals With Disabilities Education Act (IDEA), 20 U.S.C. § 1400 (2004).
- Justice, L. M., Mashburn, A. J., Hamre, B. K., & Pianta, R. C. (2008). Quality of language and literacy instruction in preschool classrooms serving at-risk pupils. *Early Child Research Quarterly*, 23(1), 51–68.
- Justice, L. M., Bowles, R. P., Pence Turnbull, K. L., & Skibbe, L. E. (2009). School readiness among children with varying histories of language difficulties. *Developmental Psychology*, 45(2), 460.
- Kagan, S. L., Moore, E., & Bredekamp, S. (1995). Reconsidering children's early learning and development: Toward shared beliefs and vocabulary.
- Keane, S. P., & Calkins, S. D. (2004). Predicting kindergarten peer social status from toddler and preschool problem behavior. *Journal of Abnormal Child Psychology*, 32(4), 409–423.
- Kusche, C. A., & Greenberg, M. T. (1994). *The PATHS curriculum*. South Deerfield: ChanningBete Co.
- La Greca, A. M., Silverman, W. K., & Lochman, J. E. (2009). Moving beyond efficacy and effectiveness in child and adolescent intervention research. *Journal of Consulting and Clinical Psychology*, 77(3), 373.
- Law, J., Garrett, Z., & Nye, C. (2004). The efficacy of treatment for children with developmental speech and language delay/disorder. *Journal of Speech, Language, and Hearing Research*.
- Leonard, L. B., Weismer, S. E., Miller, C. A., Francis, D. J., Tomblin, J. B., & Kail, R. V. (2007). Speed of processing, working memory, and language impairment in children. *Journal of Speech, Language, and Hearing Research*, 50(2), 408–28.
- Lonigan, C. J., Burgess, S. R., & Anthony, J. L. (2000). Development of emergent literacy and early reading skills in preschool children: evidence from a latent-variable longitudinal study. *Developmental Psychology*, 36(5), 596.
- Lonigan, C. J., Lerner, M. D., Goodrich, J. M., Farrington, A. L., & Allan, D. M. (2016). Executive function of Spanish-speaking language-minority preschoolers: Structure and relations with early literacy skills and behavioral outcomes. *Journal of Experimental Child Psychology*, 144, 46–65.
- Loucas, T., Charman, T., Pickles, A., Simonoff, E., Chandler, S., Meldrum, D., & Baird, G. (2008). Autistic symptomatology and language ability in autism spectrum disorder and specific language impairment. *Journal of Child Psychology and Psychiatry*, 49(11), 1184–1192.
- Masseti, G. M., Lahey, B. B., Pelham, W. E., Loney, J., Ehrhardt, A., Lee, S. S., & Kipp, H. (2008). Academic achievement over 8 years among children who met modified criteria for attention-deficit/hyperactivity disorder at 4–6 years of age. *Journal of Abnormal Child Psychology*, 36(3), 399–410.
- Mayes, S. D., Calhoun, S. L., & Crowell, E. W. (2000). Learning disabilities and ADHD: Overlapping spectrum disorders. *Journal of Learning Disabilities*, 33(5), 417–424.
- McClelland, M. M., Morrison, F. J., & Holmes, D. L. (2000). Children at risk for early academic problems: The role of learning-related social skills. *Early Child Research Quarterly*, 15(3), 307–329.
- McClelland, M. M., Acoc, A. C., & Morrison, F. J. (2006). The impact of kindergarten learning-related skills on academic trajectories at the end of elementary school. *Early Child Research Quarterly*, 21(4), 471–490.
- Morales, J., Calvo, A., & Bialystok, E. (2013). Working memory development in monolingual and bilingual children. *Journal of Experimental Child Psychology*, 114(2), 187–202.
- Mueller, K. L., & Tomblin, J. B. (2012). Examining the comorbidity of language disorders and ADHD. *Topics in Language Disorders*, 32(3), 228.
- Panter, J. E., & Bracken, B. A. (2009). Validity of the Bracken School Readiness Assessment for predicting first grade readiness. *Psychology in the Schools*, 46(5), 397–409.
- Pelham Jr., W. E., & Fabiano, G. A. (2008). Evidence-based psychosocial treatments for attention-deficit/hyperactivity disorder. *Journal of Clinical Child and Adolescent Psychology*, 37(1), 184–214.
- Ponitz, C. E. C., McClelland, M. M., Jewkes, A. M., Connor, C. M., Farris, C. L., & Morrison, F. J. (2008). Touch your toes! Developing a direct measure of behavioral regulation in early childhood. *Early Child Research Quarterly*, 23(2), 141–158.
- Redmond, S. s., Ash, A. C., Hogan, T. P., Nippold, M., & Pruitt-Lord, S. (2015). Consequences of Co-Occurring Attention-Deficit/Hyperactivity Disorder on Children's Language Impairments. *Language, Speech & Hearing Services In Schools*, 46(2), 68–80. https://doi.org/10.1044/2014_LSHSS-14-0045.
- Reynolds, C. R., & Kamphaus, R. W. (1992). *Behavior assessment system for children. Parent rating scales*. Circle Pines, MN: American Guidance Service.
- Reynolds, C. R., & Kamphaus, R. W. (2004). *Behavior assessment for children, (BASC-2)*. Circle Pines, MN: American Guidance Service.
- Sandoval, W. A., & Morrison, K. (2003). High school students' ideas about theories and theory change after a biological inquiry unit. *Journal of Research in Science Teaching: The Official Journal of the National Association for Research in Science Teaching*, 40(4), 369–392.
- Sanger, D., Moore-Brown, B. J., Montgomery, J., & Hellerich, S. (2004). Speech-language pathologists' opinions on communication disorders and violence. *Language, Speech, and Hearing Services in Schools*.
- Sciberras, E., Mueller, K. L., Efron, D., Bisset, M., Anderson, V., Schilpzand, E. J., & Nicholson, J. M. (2014). Language problems in children with ADHD: A community-based study. *Pediatrics*, 133(5), 793–800.
- Shields, A., & Cicchetti, D. (1997). Emotion regulation among school-age children: The development and validation of a new criterion Q-sort scale. *Developmental Psychology*, 33(6), 906.
- Shriberg, L. D., Tomblin, J. B., & McSweeney, J. L. (1999). Prevalence of speech delay in 6-year-old children and comorbidity with language impairment. *Journal of Speech, Language, and Hearing Research*, 42(6), 1461–1481.
- Skibbe, L. E., Justice, L. M., Zucker, T. A., & McGinty, A. S. (2008). Relations among maternal literacy beliefs, home literacy practices, and the emergent literacy skills of preschoolers with specific language impairment. *Early Education and Development*, 19(1), 68–88.
- Snowling, M. J., Bishop, D. V. M., Stothard, S. E., Chipchase, B., & Kaplan, C. (2006). Psychosocial outcomes at 15 years of children with a preschool history of speech-language impairment. *Journal of Child Psychology and Psychiatry*, 47(8), 759–765.
- Tirosh, E., & Cohen, A. (1998). Language deficit with attention-deficit disorder: A prevalent comorbidity. *Journal of Child Neurology*, 13(10), 493–497.
- Tomblin, J. B., & Mueller, K. L. (2012). How can comorbidity with attention-deficit/hyperactivity disorder aid understanding of

- language and speech disorders? *Topics in Language Disorders*, (3), 198.
- Vallance, D. D., Cummings, R. L., & Humphries, T. (1998). Mediators of the risk for problem behavior in children with language learning disabilities. *Journal of Learning Disabilities*, 31(2), 160–171.
- Webster-Stratton, C. (2000). *The incredible years training series* (pp. 1–24). Washington, DC: US Department of Justice, Office of Justice Programs, Office of Juvenile Justice and Delinquency Prevention.
- Webster-Stratton, C., Reid, M., & Stoolmiller, M. (2008). Preventing conduct problems and improving school readiness: evaluation of the incredible years teacher and child training programs in high-risk schools. *Journal of Child Psychology and Psychiatry*, 49(5), 471–488.
- Webster-Stratton, C., Reid, M. J., Weisz, J. R., & Kazdin, A. E. (2010). Evidence-based psychotherapies for children and adolescents. Guilford Publications, New York.
- Wechsler, D. (2012). Wechsler Preschool and Primary Scales of Intelligence (WPPSI-IV).
- Weiss, M., Worling, D., & Wasdell, M. (2003). A chart review study of the inattentive and combined types of ADHD. *Journal of Attention Disorders*, 7(1), 1–9.
- Woodcock, R. W., McGrew, K. S., & Mather, N. (2001). *WJ-III tests of achievement*. Itasca: Riverside Publishing.
- Zentall, S. S., Cassady, J. C., & Javorsky, J. (2001). Social comprehension of children with hyperactivity. *Journal of Attention Disorders*, 5(1), 11–24.
- Zimmerman, I. L., Steiner, V. G., & Pond, R. E. (2011). PLS-5: Preschool language scale-5 San Antonio. In *TX: Psychological Corporation*.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.