



## Sustained effects of a school readiness intervention: 5th grade outcomes of the Head Start REDI program



Janet A. Welsh<sup>a,\*</sup>, Karen L. Bierman<sup>b</sup>, Robert L. Nix<sup>c</sup>, Brenda N. Heinrichs<sup>b</sup>

<sup>a</sup> The Bennett-Pierce Prevention Research Center, Pennsylvania State University, United States

<sup>b</sup> The Department of Psychology, Pennsylvania State University, United States

<sup>c</sup> The Department of Human Development & Family Studies, University of Wisconsin-Madison, United States

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### ABSTRACT

This study examined the sustained effects of the Head Start Research-based Developmentally Informed (REDI) program, which enriched preschools with evidence-based programming targeting social-emotional and language/emergent literacy skills. 44 Head Start classrooms were randomly assigned to intervention or a usual practice control group, and 356 4-year-olds (25% African American, 17% Latino, 54% female) were followed through the end of 5th grade. Growth curve analyses revealed that significant intervention effects on teacher-rated social adjustment, academic engagement, and parent involvement identified at the end of the Head Start year were sustained throughout elementary school. These findings demonstrate that evidence-based curricula combined with professional development support can enhance preschool programming and promote the elementary school adjustment of children living in poverty.

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A central goal of Head Start and other publicly supported early childhood programs is to lift children out of poverty by building their school readiness, thus placing them on a more favorable developmental trajectory that allows them to achieve maximum benefits from subsequent educational experiences. The hope for long-term benefits stems from evaluations of model preschool programs dating back to the 1960s that followed participants into adulthood. For example, relative to no-preschool comparison groups, children who attended the Perry Preschool or Abecedarian programs completed more years of education and had higher levels of employment and income as adults (Campbell, Ramey, Pungello, Sparkling, & Miller-Johnson, 2002; Schweinhart et al., 2005).

Dramatic changes have occurred in the landscape of early education programming since the seminal studies documenting long-term benefits were conducted (Lowenstein, 2011). Increases in maternal employment and growth in publicly funded prekindergarten programs have greatly increased preschool attendance; by 2012, 65% of children age 3–5 attended some type of early education program (Snyder, de Brey, & Dillow, 2016, pg. 81). Correspondingly, the pressing policy questions of interest have shifted away from the value of preschool (versus no preschool) and now center on

identifying the type of preschool programming that can optimize children's later school success (Duncan & Magnuson, 2013). Over the past two decades, an increasing number of rigorous randomized trials have demonstrated short-term benefits for interventions involving preschool curricula and professional development supports (Jenkins et al., 2018; Yoshikawa et al., 2013). However, follow-up studies suggest that the academic benefits of these programs typically fade during the early elementary years (Claessens & Engel, 2013; Duncan & Magnuson, 2013; Preschool Curriculum Evaluation Research Consortium, 2008). Interestingly, a number of researchers have speculated that enriched preschool experiences may produce longer-term benefits by enhancing children's social-emotional and self-regulation skills, rather than by boosting academic knowledge (Deming, 2009; Heckman, Pinto, & Savelyev, 2013). These speculations have increased interest in and evaluations of formal preschool social-emotional learning (SEL) curricula and professional development supports (Bierman & Motamedi, 2015; McClelland, Tominey, Schmitt, & Duncan, 2017; Morris et al., 2014). However, very few studies have examined the sustained effects of preschool SEL through elementary school.

This study reports on the 5th grade follow up of the Head Start REDI program, which enriched classroom curricula with evidence-based SEL and language/literacy programming and provided concurrent professional development support. Like a number of other contemporary preschool interventions, the REDI trial focused on enhancing the school readiness and later school success

Abbreviations: REDI, Research-based, Developmentally-Informed.

\* Corresponding author.

E-mail address: jaw900@psu.edu (J.A. Welsh).

of children from low-income families, comparing enriched Head Start to usual practice Head Start classrooms.

### 1. Poverty and its impact on school readiness

Boosting the school readiness of children from low-income families is a priority, given well-documented links between poverty and poor educational outcomes (Ryan, Fauth, & Brooks-Gunn, 2006). Low-income families often face adversities, including crowded and unsafe living conditions, family instability, single parenting, and increased exposure to violence, that reduce caregivers' capacity to provide optimal support for children's early development (Ryan et al., 2006). In addition, low-income families have limited resources, including both less education and less access to high quality child-care and schools compared to more advantaged families (Evans & Kim, 2013). Researchers have raised concerns that exposure to the chronic stressors that characterize poverty in early childhood overloads stress responses and floods the hypothalamic-pituitary-adrenal axis, increasing impulsive responding and impeding the development of the executive functions that support goal-oriented learning (Blair & Raver, 2015). In addition, under-resourced family contexts can undermine sensitive-responsive caregiving, reducing support for early language, cognitive, and social-emotional development (Bradley & Corwyn, 2002). At least one study found neurobiological differences in brain development between poor and non-poor children, with children from low income families showing reductions in gray matter volume and also lower performance on school readiness assessments (Hair, Hanson, Wolfe, & Pollak, 2015).

For these reasons, children living in economically disadvantaged homes are more likely to enter kindergarten less ready to succeed than more advantaged classmates, with under-developed language and pre-academic skills, fewer social-emotional competencies, heightened levels of behavior problems, reduced academic engagement, and possibly underdeveloped neurobiology that reduces their ability to benefit from educational experiences (Brooks-Gunn & Markman, 2005; Evans & Rosenbaum, 2008; Hair et al., 2015; Raver & Knitzke, 2002; Ryan et al., 2006). These gaps associated with family income do not diminish over time, resulting in disparities that include reduced academic achievement throughout elementary and secondary school, increased risk for high school drop-out, reduced employment opportunities and compromised physical and mental health in adulthood (Duncan & Magnuson, 2013; Engle & Black, 2008; Ryan et al., 2006).

### 2. Prioritizing social-emotional and self-regulation skills in preschool intervention

Developmental theorists have speculated that children exposed to the heightened adversities associated with poverty might especially benefit from an intensive focus on social-emotional skill-building during the preschool years to promote the development of the mental systems that support self-regulated learning and the adaptive behaviors needed for school success (Blair, 2002; Denham & Burton, 2003; McClelland, Acock, & Morrison, 2006). For example, teaching children how to identify and manage strong feelings may help reduce their feelings of distress, increase self- and social-understanding, and help children cope effectively with the social and academic demands of school (Izard et al., 2008). Teaching self-calming strategies and practicing intentional self-control routines may help children learn to inhibit impulsive behavior and engage in adaptive, goal-oriented learning and social behavior (Riggs, Greenberg, Kusché, & Pentz, 2006). Focusing on friendship skills and social problem-solving may help children effectively manage and resolve interpersonal conflicts and reduce aggressive-disruptive

behaviors (Denham, Zinsler, & Brown, 2012). Promoting this set of skills should also strengthen executive functioning, enhancing the neural systems that support self-regulation (Greenberg, 2006; Riggs et al., 2006).

Longitudinal research demonstrates that these skills predict reduced discipline problems over time, elevated high school graduation rates, future employment, and adult health (Denham et al., 2012). In fact, one longitudinal study showed that brief teacher ratings of social skills and behavioral control at kindergarten entry predicted a host of important outcomes at age 25, including the likelihood of attaining a college degree and stable employment, and reduced arrests, substance use problems, and mental health problems (Jones, Greenberg, & Crowley, 2015).

### 3. Preschool enrichment programs targeting social-emotional skills and school readiness

An accumulating set of randomized controlled trials provide strong evidence that the use of evidence-based programming promotes social-emotional and self-regulation skills during the preschool years (see reviews by Bierman & Motamedi, 2015; McClelland et al., 2017).

Several successful SEL programs provide explicit skill instruction. These programs include scripted classroom lessons in which teachers use stories, pictures, and puppets to present skill concepts, followed by guided activities that allow children to practice the skills in role plays or planned activities. Subsequently, teachers prompt and reinforce skill performance in the classroom. Using this approach, at least three randomized controlled trials have documented a positive impact of the Preschool PATHS (Promoting Alternative Thinking Strategies) curriculum on child emotion knowledge and social problem-solving skills, and on socially competent and self-regulated learning behaviors (Domitrovich, Cortes, & Greenberg, 2007; Hamre, Pianta, Mashburn, & Downer, 2012; Morris et al., 2014). Similar results for other programs using explicit SEL lessons in randomized trials include AI's Pals, which produced improvements on teacher rated social competence and reduced behavior problems (Lynch, Geller, & Schmidt, 2004) and the Second Step early learning curriculum, which produced significant improvements on children's executive function skills (Uphur, Heyman, & Wenz-Gross, 2017).

Recognizing the important role of predictable and sensitive-responsive socialization supports for the development of social-emotional and self-regulation skills, preschool interventions have also targeted teacher and parent emotional support and positive management skills. For example, several randomized controlled trials support the effectiveness of the Incredible Years teacher training program in decreasing classroom behavior problems and increasing child learning engagement by providing teachers with intensive professional development support on the effective use of positive attention and praise, student-teacher relationship building, and non-punitive limit-setting (Morris et al., 2014; Morris, Millenky, Raver, & Jones, 2013; Raver et al., 2009; Webster-Stratton, Reid, & Hammond, 2001). Adding parallel supports for parents increased program impact by increasing parent involvement and strengthening parent support for child learning at home (Webster-Stratton et al., 2001).

A major limitation of these studies, however, is the paucity of follow-up assessments after children transition into kindergarten and through the elementary school years. Conceptually, enhanced social-emotional skills at elementary school entry should allow children to engage actively in classroom activities and form positive relationships with peers and teachers, thereby preventing a negative cascade of behavioral and social maladjustment that might otherwise occur (Denham et al., 2012). In addition, growth in

self-regulation skills should foster focused and persistent learning efforts, and by strengthening the neural foundation for attention control, enhance children's capacities to benefit from classroom instruction (Greenberg, 2006).

#### 4. The Head Start REDI program

To strengthen long-term effects, the Head Start REDI program combined an explicit SEL program with curriculum components targeting language and early literacy skills, provided substantial professional development supports for teachers, and included out-reach materials for parents. The foundation of REDI was Preschool PATHS (Domitrovich et al., 2007), a universal, teacher-delivered program promoting social skills, emotional understanding, intentional self-control, and problem-solving skills. PATHS included 33 lessons organized into four units: friendship skills, feelings, self-control, and problem solving. Weekly lessons taught specific skills with stories, puppets, and discussions and were supplemented with weekly extension activities, such as role plays, games, and crafts, that gave children opportunities for guided practice in the target skills.

REDI built on this foundation by adding three evidence-based curriculum components designed to enhance child emergent literacy skills, language, and social reasoning skills in order to further boost child self-regulation capacities and learning engagement (Lonigan, Farver, Phillips, & Clancy-Menchetti, 2011; Wasik, Bond, & Hindman, 2006). Specifically, PATHS was integrated with a daily reading program in which teachers utilized props, novel vocabulary, and scripted questions to encourage child participation and promote advanced thinking and language skills (Wasik et al., 2006). The books used for interactive reading were coordinated with the PATHS social-emotional themes, providing children with an “extra dose” of exposure to SEL concepts. For example, during weeks that include lessons on the feeling “mad,” books about characters managing their anger were read and discussed. Teachers also led sound games to develop phonological awareness (Adams, Foorman, Lundberg, & Beeler, 1998), and used alphabet centers to promote letter knowledge (Lonigan et al., 2011).

Finally, REDI staff worked with classroom teachers to establish classroom order and provided parents with information and out-reach to increase positive support for the exertion of the effortful control of emotion and behavior across school and home settings (Greenberg, 2006). Teaching strategies were designed to support SEL (e.g., positive classroom management, specific and effective praise, emotion coaching, and induction strategies to promote self-control) and enrich classroom language use (e.g., dialogue with questions and extensions, new vocabulary used in context). Parents received three “take-home” packets during the course of the year, each containing a modeling videotape, with parenting tips and learning activities to use at home. Children also received weekly PATHS curriculum handouts and took letter stickers and compliment pages to prompt their parents to ask them about their school day. The goal was to strengthen parent involvement and boost home support for learning.

The REDI logic model anticipated that children would develop targeted skills as a result of exposure to the systematic and carefully sequenced curriculum components and improved socialization support from teachers and parents. The model further anticipated that the integrated focus on SEL and language/emergent literacy skills would have synergistic effects, strengthening benefits in both social-emotional and language/literacy domains (Nix, Bierman, Domitrovich, & Gill, 2013). Research suggests that skill-focused curricula such as the emergent literacy intervention components used in REDI promote significant gains in the targeted areas of child skill acquisition; however, benefits appear domain-specific,

rarely extending beyond the targeted skill domain (Jenkins et al., 2018). In contrast, it was anticipated that social-emotional and self-regulation skills would function as domain-general skills, strengthening foundational skills for cognitive and behavioral adaptation to boost multiple areas of school success (Blair, 2002).

##### 4.1. Prior outcome evaluations of REDI

At the end of preschool, children in centers randomly assigned to receive the REDI enrichments, relative to children in usual practice Head Start, scored significantly better on measures of social-emotional and self-regulation skills, including emotional understanding and social problem-solving, learning engagement, and reduced aggression (standardized mean differences, Cohen's  $d$ , [Cohen, 1988] = .21–.35; Bierman et al., 2008a; Bierman, Nix, Greenberg, Blair, & Domitrovich, 2008b). Significant post-intervention effects also emerged for vocabulary and phonological awareness skills, as well as a marginal impact on print awareness ( $ds = .15$ – $.39$ ). One year later, after children had transitioned into kindergarten, longitudinal follow-up assessments revealed sustained effects in the same social-emotional domains, including social problem-solving skills, learning engagement, and reduced aggression ( $ds = .22$ – $.40$ ; Bierman et al., 2014). However, by the end of kindergarten, the only remaining significant intervention effect for literacy skills was on phonemic decoding ( $d = .25$ ); effects on vocabulary and other emergent literacy skills (e.g., print knowledge and sight word recognition) had faded to non-significance. Interestingly, features of the kindergarten school context, such as degree of reading instruction delivered, school-level achievement, and quality of teacher–student interactions, accounted for significant variance in measures of emergent literacy skills, suggesting that the effects of the preschool intervention were swamped by the more proximal impact of kindergarten instruction of these literacy skills (Bierman et al., 2014). Two years later, when children were finishing second grade, follow-up assessments revealed sustained social-emotional benefits in areas of social competence, student–teacher relationships, and academic engagement ( $ds = .20$ – $.39$ ), but no remaining evidence for impact on direct assessments of child literacy skills or teacher ratings of academic achievement (Bierman, Heinrichs, Welsh, Nix, & Gest, 2017).

#### 5. The current study

The purpose of the present study was to track the social-emotional outcomes of these Head Start children as they progressed to the end of elementary school, examining the degree to which social-emotional benefits associated with the REDI intervention were sustained through 5th grade. Based on prior follow-up assessments documenting fade-out of intervention effects on language and literacy skills, achievement tests were not administered in 5th grade. Hence, this study focused specifically on the social-emotional outcomes associated with REDI, using growth curve analyses to determine whether initial intervention gains observed in areas of social adjustment, behavior problems, academic engagement remained evident through the end of elementary school.

Fifth grade marks a particularly important transition point in child development, as this is when children are completing elementary school and poised to take on the challenges of middle school and emerging adolescence. As such, children's social-emotional well-being in 5th grade provides a foundation that may either enhance resilience or amplify risk as they move forward (Archambault, Janosz, Morizot, & Pagani, 2009). Given the pattern of findings in earlier years, it was hypothesized that REDI intervention effects would be sustained through the end of 5th grade in three domains of social-emotional functioning: social adjustment,

reduced behavior problems, and academic engagement. In addition, this study examined sustained intervention effects on parent involvement, which was a component of REDI but not examined in prior outcome studies.

## 6. Method

This study was conducted in compliance with the ethical standards of the American Psychological Association, with the approval of the Institutional Review Board at the Pennsylvania State University. All parents and teachers in this study provided signed informed consent for participation.

### 6.1. Participants

Participants were 356 children (25% African American, 17% Latino, 54% female), recruited from Head Start programs serving three rural and small urban communities in Pennsylvania. Most children came from low-income families; the median annual family income was about \$15,000, and the average income-to-needs ratio was .88. About 40% of children lived with a single parent. Thirty-one percent of the parents had not completed high school; 60% of parents had graduated from high school or received a GED; 7% completed a technical degree; and 2% completed college. English was the only language spoken at home for 80% of the families; Spanish and English were both spoken at home for 18%; and only Spanish was spoken at home for 2% of the families.

Families were invited into the study in two consecutive cohorts, at the beginning of the Head Start school year when children were 4–5 years old; 86% of eligible families consented. At study entry, children were in 44 classrooms in 25 Head Start centers. Centers were stratified based on county, program features (e.g., full-day versus half-day), and population demographics (e.g., percent of children of color) and randomly assigned to intervention or control conditions. Classrooms within a center were assigned to the same condition. Analyses of baseline data indicated that the randomization was successful; there were no significant intervention-control group differences on any of the measures used in this study.

Because the Head Start centers served the entire county and not any particular school district, children were widely dispersed across schools upon leaving Head Start. At elementary school entry, the 356 participants transitioned into 202 kindergarten classrooms in 82 elementary schools in 33 school districts. Given this dispersion, there was little nesting in elementary classrooms; most children were the only study participant in their classroom (70% in 1st grade rising to 78% by 5th grade). Virtually all of the children had new teachers every year, making ratings over time independent at the level of the teacher. Analyses of elementary school-level data indicated no significant differences in the quality of schools attended by intervention and control group children, based on measures of school-level poverty and school-level achievement.

Sample attrition was generally low and averaged about 3% per wave, with a retention rate of 81% in 5th grade. Most of the attrition was due to family moves and inability to locate families. Children who were and were not retained did not differ on any baseline measures of social-emotional functioning or family demographic characteristics except race: African American children were slightly more likely to be lost at follow-up, but their rates of attrition did not differ across the intervention and control groups.

### 6.2. Intervention procedures

Teachers received detailed manuals and kits containing all materials needed to implement the intervention. Training work-

shops occurred prior to intervention implementation (3 days) and mid-year (1 day). REDI coaches made weekly classroom visits and held weekly coaching meetings to enhance the quality of implementation and foster use of REDI teaching strategies.

Asked to complete one PATHS lesson and one extension activity per week, teachers reported implementing 1.77 lessons and extension activities on average per week. Asked to complete four interactive reading lessons and two extension activities per week, teachers reported implementing 6.08 lessons and extension activities on average per week. Asked to complete three sound games per week, teachers reported implementing 2.57 sound games on average per week. Asked to have the alphabet center available for children to visit at least “several” times per week, teachers reported implementing 3.56 center activities per week. REDI coaches provided monthly ratings of the quality of program implementation, which averaged 4.39–4.70 on a 5-point scale across the 4 intervention components, corresponding to scores between “adequate” and “strong” (see Bierman et al., 2008a; Bierman, Nix, et al., 2008b for details).

### 6.3. Assessment procedures

The teacher ratings that provided the outcome data modeled in this study were collected over six waves, near the end of the school year at each wave (e.g., Head Start, kindergarten, 1st grade, 2nd grade, 3rd grade, and 5th grade). For the first four waves of data collection, research assistants delivered and explained measures to teachers, who completed their ratings and returned them to the project via mail. Subsequently, teachers received and completed measures on line. After the Head Start year, teachers were unaware of which students had participated in the REDI intervention as preschoolers. Baseline covariates were collected at the start of the Head Start year.

### 6.4. Measures

At each wave of outcome data collection, teachers completed ratings on children’s social adjustment, behavior problems, academic engagement, and parent involvement.

#### 6.4.1. Social adjustment

Three measures assessed social adjustment. The *Social Competence Scale* (Conduct Problems Prevention Research Group [CPPRG], 1995) included 13-items describing prosocial behaviors and emotion regulation (e.g., shares with others, controls temper in a disagreement). Items were rated on a 6-point scale (1 = almost never to 6 = almost always;  $\alpha = .94-.96$  across the seven waves of measurement). Four items from the Excluded by Peers subscale of the *Child Behavior Scale* (Ladd & Profilet, 1996) were used to assess peer problems (e.g., is left out or ignored by classmates, is teased or picked on by classmates), each rated on a 6-point scale (1 = almost never to 6 = almost always;  $\alpha = .83-.88$ ). The closeness scale of the *Student-Teacher Relationship Scale* (Pianta, 2001) included 8 items describing the child’s relationships with classroom teachers (e.g., “I share an affectionate, warm relationship with this child,” “This child values her/his relationship with me”), each rated on a 5-point scale (1 = definitely does not apply to 5 = definitely applies;  $\alpha = .88-.92$ ). Each scale was totaled and then divided by the number of items to create an average item score. Values for the *Child Behavior Scale* were reverse coded, and values for the *Student-Teacher Relationship Scale* were adjusted using a simple linear transformation so that the scale was 1 to 6, to be comparable to the other two measures in this domain. These three measures of social adjustment were significantly correlated at each wave of measurement ( $r = .34-.74$ ) and were averaged ( $\alpha = .72-.77$ ).

#### 6.4.2. Behavior problems

Two measures assessed behavior problems. Teachers rated 7 items from the Authority Acceptance subscale of the *Teacher Observation of Classroom Adaptation – Revised* (Werthamer-Larsson, Kellam, & Wheeler, 1991) to assess aggressive-oppositional behaviors (e.g., fights with other children, ignores or refuses to obey adults) using a 6-point scale (1 = almost never to 6 = almost always;  $\alpha = .89-.93$ ). Teachers also rated 6 items from the *Children's Social Behavior Scale – Teacher Version* (Crick, 1996) to assess relational aggression (e.g., spreads rumors or gossip, ignores or stops talking to a peer when mad) using a 6-point scale (1 = almost never to 6 = almost always;  $\alpha = .94-.96$ ). For each scale, the total score was divided by the number of items to create an average item score. These two aggression measures were significantly correlated at each wave of measurement ( $r = .50-.66$ ) and were averaged.

#### 6.4.3. Academic engagement

Two variables were combined to create the academic engagement composite. Teachers used a 7- or 14-item (depending on the year) version of the *School Readiness Questionnaire* (Bierman et al., 2008a; Bierman, Nix, et al., 2008b) to describe learning engagement (e.g., enthusiastic about learning new things, careful with her/his work) with a 6-point scale (1 = almost never to 6 = almost always;  $\alpha = .93-.97$ ). Teachers also completed the 8-item Inattentive-Impulsive subscale of the *ADHD Rating Scale* (DuPaul, 1991), rating attention problems (e.g., easily distracted, trouble following directions) on a 4-point scale (1 = not at all to 4 = very much;  $\alpha = .93-.96$ ). Each scale was totaled and divided by the number of items to create average item scores. Values for the *ADHD Rating Scale* were reverse coded and rescaled to be comparable to the other measure in this domain. These two measures of academic engagement were significantly correlated at each wave ( $r = .72-.81$ ) and were averaged to create a composite.

#### 6.4.4. Parent involvement

Finally, parent involvement in children's education was assessed with the *Parent-Teacher Involvement Questionnaire* (Kohl, Lengua, McMahon, & the Conduct Problems Prevention Research Group, 2000). On this 9-item scale, teachers rate their impressions of parent support for education (e.g., involved in child's education, do things to encourage a positive attitude toward education) using a 5-point scale (1 = not at all to 5 = a great deal;  $\alpha = .90-.95$ ). Scores were summed and divided by the number of items to create an average item score.

#### 6.4.5. Study covariates

A set of covariates assessed at baseline, prior to the beginning of the REDI intervention, was included in this study to increase the precision of estimates of intervention effects and control for any pre-existing but nonsignificant differences across groups. These included study design features (e.g., cohort, county site), demographics (e.g., child sex, age, race, and family income-to-needs ratio), direct assessments of child skills (e.g., IQ, vocabulary, executive functions, emotional understanding). In addition, as covariates for the social adjustment, aggressive behavior problems, and attention problems, we included baseline parent ratings completed on the respective scales that were identical to the measures rated by teachers in the later years. (There was no similar covariate for the parent involvement outcome.) Baseline parent ratings were used as covariates because intervention was underway prior to the collection of initial teacher ratings.

#### 6.5. Plan for analyses

Hierarchical linear models (Singer & Willett, 2003) were estimated for each of the four study outcomes. Intraclass correlation

coefficients for children from the same Head Start classrooms were negligible and not statistically significant after elementary school entry, likely due to the wide dispersion of the sample across schools and classrooms, making it unnecessary for models to account for the nesting of children in Head Start classrooms. Thus, two-level models were estimated, nesting time within children. At Level 1, models estimated change over time in each outcome, starting at the post-intervention assessments at the end of the Head Start year and continuing through 5th grade. At Level 2, models included the fixed effects of intervention status and the study covariates. It is important to note, that although the baseline measures of the outcomes are included in the growth curve models as covariates, the developmental trajectories do not start until after the conclusion of the intervention period. Because this study focused on the sustained effects of the intervention across the course of elementary school, the intercept was centered at 5th grade.

Growth curve models were estimated for each outcome, allowing for both random slopes and random intercepts, so that a unique growth curve was computed for each child in the study. Given that the objective of this study was to test group differences, mean growth curves were examined for children in the intervention and control groups (McNeish & Matta, 2017). Initial growth curves allowed for linear, quadratic, and cubic effects of time. In addition, those initial growth curves included the interactions of each parameterizations of time with intervention status to allow for the possibility that REDI changed the form of the developmental trajectories children in the intervention group followed. Models were trimmed of all effects of time and interactions with time that were not statistically significant or that did not improve model fit according to Akaike or Bayesian information criteria (Burnham & Anderson, 2002). In all growth models, all of the interactions of time with intervention status were nonsignificant or failed to improve model fit and, thus, were trimmed. Hence, even though random slopes were estimated, there were no differences in the mean slopes across intervention conditions, indicating that the shape of the developmental trajectories of children in REDI and children in Head Start as usual were identical within sampling error and ran parallel to one another.

Because there were no group differences on slope, intervention effects represent average group differences across all of the study waves, anchored at the 5th grade intercept. Effect sizes were computed by dividing the estimated intervention effects by the sample standard deviation at 5th grade (Feingold, 2013). These effect sizes are comparable to Cohen's  $d$  (Cohen, 1988) controlling for the study covariates.

## 7. Results

Sample means, standard deviations, ranges, and correlations at the end of Head Start and end of 5th grade are shown in Table 1. From the end of Head Start to the end of 5th grade, each outcome was moderately correlated with itself ( $r = .24-.39$ ), suggesting substantial within individual change across time. At both Head Start and 5th grade, however, the composite measures of child functioning were strongly correlated with one another ( $r$  [absolute value] = .50-.79) and moderately correlated with parent involvement ( $r$  [absolute value] = .19-.36).

### 7.1. Social adjustment

Results for the growth curve model of social adjustment are presented in Table 2 and illustrated in Fig. 1. In general, teacher ratings of child social adjustment declined gradually over time. Participation in the Head Start REDI intervention had a significant effect on the 5th grade intercept for social adjustment,  $\beta = 0.26$ ,

**Table 1**  
Correlations among study outcomes at the end of Head Start and 5th grade.

Variables	Mean	SD	Min	Max	1	2	3	4	5	6	7
<i>Head Start</i>											
1. Social adjustment	4.86	.60	2.23	5.95							
2. Behavior problems	1.95	.81	1.00	5.13	-.57						
3. Academic engagement	4.92	.95	1.57	6.00	.79	-.50					
4. Parent involvement	3.94	1.09	1.14	6.00	.36	-.19	.34				
<i>5th grade</i>											
5. Social adjustment	4.58	.78	2.52	6.00	.27	-.21	.25	.13			
6. Behavior problems	1.79	.86	1.00	5.07	-.14	.27	-.17	-.15	-.56		
7. Academic engagement	4.53	1.14	1.21	6.00	.28	-.25	.39	.13	.64	-.53	
8. Parent involvement	3.39	1.19	1.00	5.86	.05	-.04	.03	.24	.31	-.21	.25

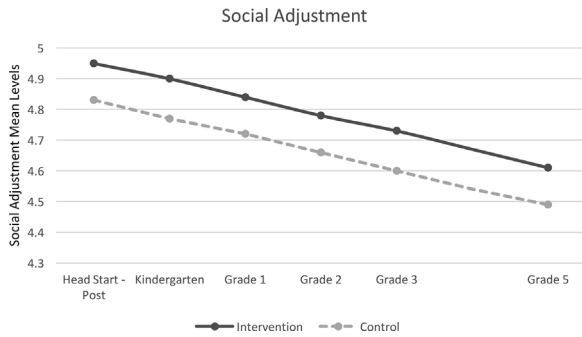
Note: Mean scores represent average item ratings. SD, standard deviation; Min, minimum; Max, maximum. All correlations are statistically significant,  $p < .05$ .

**Table 2**  
Summary of growth curves and Head Start REDI intervention effects.

	Effects of time			Effects of intervention	
	Linear	Quadratic	Cubic	Coefficient at 5th grade	Effect size (Cohen's <i>d</i> )
Social adjustment	-.07**	-	-	.26**	.34
Behavior problems	-.34**	-.14**	-.01**	-.10	.12
Academic engagement	-.20*	-.11*	-.01**	.27**	.24
Parent involvement	-.21*	-.09*	-.01**	.28**	.24

Note: The effect size is assessed at the fifth grade intercept and in these models it represents the average intervention effect across time.

\*\*  $p < .01$ .  
\*  $p < .05$ .



**Fig. 1.** Intervention effects on social adjustment. Note: Predicted values are derived from the growth curve models, beginning at post-intervention, adjusted for covariates.

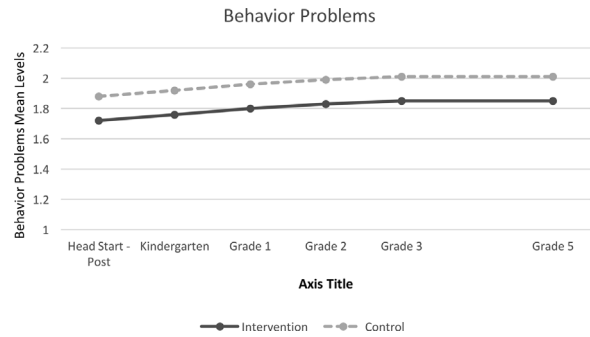
$p < .001$ ,  $d = .34$ . These findings reflect a sustained impact of the Head Start REDI intervention, with the boost to children's social adjustment evident at the end of Head Start sustained through the end of elementary school. The small to moderate effect size indicates that, on average, predicted means for children in the intervention group were about one-third of a standard deviation higher than means for children in the control group.

7.2. Behavior problems

Results for the growth curve model of behavior problems are presented in Table 2 and illustrated in Fig. 2. Teacher ratings of children's behavior problems increased slightly in the early elementary years, then leveled off. Participation in the Head Start REDI intervention had no lasting significant effect on children's behavior problems,  $\beta = -.10$ ,  $p < .14$ ,  $d = .12$ .

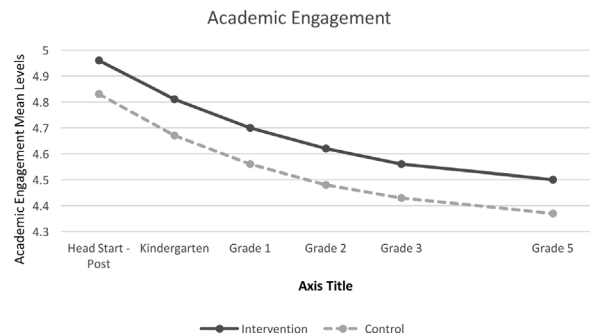
7.3. Academic engagement

Teacher ratings of academic engagement started high and declined over time. Participation in the Head Start REDI intervention had a significant effect on academic engagement evident

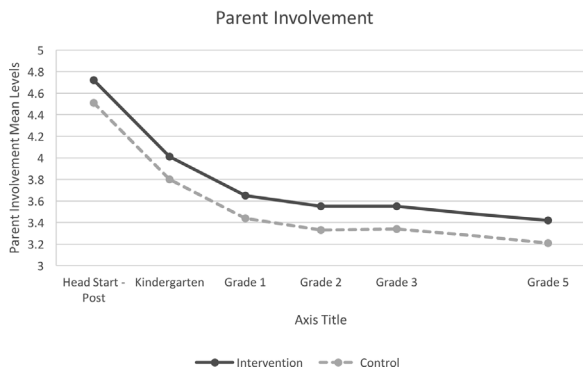


**Fig. 2.** Intervention effects on aggressive behavior problems. Note: Predicted values are derived from the growth curve models, beginning at post-intervention, adjusted for covariates.

at post-intervention and sustained throughout elementary school,  $\beta = .27$ ,  $p < .001$ ,  $d = .24$  (see Fig. 3). The small effect size indicates that, on average, predicted means for children in the intervention group were about one-quarter of a standard deviation higher than means for children in the control group.



**Fig. 3.** Intervention effects on academic engagement. Note: Predicted values are derived from the growth curve models, beginning at post-intervention, adjusted for covariates.



**Fig. 4.** Intervention effects on parent involvement. Note: Predicted values are derived from the growth curve models, beginning at post-intervention, adjusted for covariates.

#### 7.4. Parent involvement

The results for the growth curve model of parent involvement are presented in Table 2 and illustrated in Fig. 4. Parent involvement declined from the end of Head Start through 1st grade, leveled off through 3rd grade, and then gradually declined again. The REDI intervention promoted parent involvement,  $\beta = .28$ ,  $p < 0.002$ ,  $d = .24$ . The small effect size indicates that, on average, predicted means for parents of children in the intervention group were about one-quarter of a standard deviation higher than means for parents of children in the control group.

## 8. Discussion

Six years after participating in the REDI enrichment program during Head Start, children continued to show benefits in multiple areas of social-emotional functioning, including social adjustment, academic engagement, and parent involvement, relative to children who received usual practice Head Start. The intervention effect on reduced behavior problems that was significant at the end of Head Start and end of kindergarten had faded to non-significance when examined over the course of elementary school. Across the outcomes, there were no intervention-control group differences in rate of change. In other words, the boosts in social-emotional functioning that children exhibited at the end of Head Start as a result of participating in REDI remained consistent throughout elementary school but did not decrease or accelerate.

The size of the significant intervention effects estimated at the 5th grade intercept were small to moderate ( $ds = .24-.34$ ). These effect sizes are comparable to the magnitude of the intervention effects documented in a meta-analysis of follow-up studies of school-based universal SEL programs, which ranged from .11 to .32 (Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011). The What Works Clearinghouse generally considers effect sizes above .25 to be substantively important for improving educational impact (Institute of Educational Sciences, 2017); the effect here on social adjustment exceeds this cut-off ( $d = .34$ ) and the effects on academic engagement and parent involvement approach it ( $d = .24$ ). To aid interpretation of the practical importance of an intervention effect, What Works Clearinghouse translates effect sizes into an “improvement index” that represents the difference between percentile ranks for the intervention and control groups. The effect of .24 on academic engagement and parent involvement translates into an improvement index of 10%, suggesting that the intervention would have led to a 10% percentile rank increase for an average control group student and that 60% of the students in the intervention group scored above the control group mean. The

effect of .34 on social adjustment translates into an improvement index of 13%.

At a population level, these small effects may have meaningful impacts on later outcomes, as children transition into middle school and face heightened risks for school disengagement and problem behaviors. At this point it is unclear whether these benefits will sustain or diminish further in later years.

The REDI trial was similar to other contemporary evaluations of preschool interventions in that children in the control group received typical Head Start rather than receiving no preschool, as was more common in earlier generations of preschool research (Campbell et al., 2002; Schweinhart et al., 2005). As such, this study demonstrates that intensive evidence-based programming can improve the sustained impact of Head Start on child social-emotional outcomes, at least through the end of elementary school.

#### 8.1. Sustained effects versus fade-out

REDI was designed to promote gains in both social-emotional and language/literacy domains. Similar to a number of other studies (see Bailey, Duncan, Odgers, & Yu, 2017, and Lowenstein, 2011, for reviews), the language/literacy gains that REDI promoted by the end of preschool faded considerably by the end of kindergarten and completely by the end of second grade (Bierman et al., 2017). The sustained effects reported here were found only in the social-emotional domain. Other preschool programs, including the Abecedarian project (Campbell et al., 2002) and Perry Preschool program (Schweinhart et al., 2005) have found a similar pattern of results with preschool social-emotional gains sustaining longer than academic gains (see also Barnett & Carolan, 2014). Researchers have speculated that academic fade-out occurs when children enter low-quality elementary classrooms that lack alignment with enriched preschool programming and fail to leverage preschool gains (Reynolds, Magnuson, & Ou, 2010). However, some research suggests that the fade out of preschool effects may actually be greater in higher-quality kindergartens because children in the control condition are most likely to “catch up” in these contexts (Bassok, Gibbs, & Latham, 2017; Magnuson, Ruhm, & Waldfogel, 2007). The latter appeared to be the case in Head Start REDI, where school-level achievement levels, the quality of student-teacher interactions, and the amount of literacy instruction experienced in kindergarten classrooms predicted children’s literacy skills at the end of kindergarten, essentially swamping the effects of the earlier preschool experience for most children (Bierman et al., 2014).

It is less clear what factors may affect the developmental course of benefits derived from preschool SEL programming. Conceptually, the emergent literacy skills taught in REDI (letter knowledge and phonological awareness) are domain-specific and constrained (Paris, 2005); one can accelerate the pace of learning with early intervention, but eventually other children will catch up with instruction (Bailey et al., 2017). In contrast, the social-emotional and self-regulation skills taught in REDI are domain general and unconstrained. The deficits in emotion regulation, behavioral control, and executive function skills that are associated with early adverse experiences can be life-long, contributing to school difficulties in both cognitive and behavioral domains (Blair & Raver, 2015). Early intervention that promotes growth in these skills and supports development of the neural foundations of attention control may facilitate capacity for learning and adaptation in the school context, thereby promoting sustained gains (see also Bierman, Nix, et al., 2008b).

In the context of heightened expectations for children to sit, listen, and learn in kindergarten, children’s social-emotional skills at school entry may be particularly adaptive, allowing them to better inhibit disruptive and aggressive behaviors, form more positive relationships with teachers and peers, and engage more actively

in classroom activities and learning tasks. Without intervention to promote cognitive and behavioral self-regulation skills, economically disadvantaged children with regulatory difficulties may be overwhelmed by school demands and elicit negative treatment from peers and teachers that further undermines their adaptation. Hence, there may be less catch up in the control group after the kindergarten transition, and more natural reinforcement for learned social skills in the social-emotional domain, relative to the academic domain.

In addition, it is possible that less alignment is needed between preschool and kindergarten programming to leverage preschool gains in social-emotional domains, relative to academic domains. That is, research is emerging to suggest that curriculum alignment across preschool and kindergarten may need to be quite specific to support skill acquisition in academic areas like math and literacy that are characterized by learning progressions and a need for instruction that is tailored to the level of child knowledge (Bailey et al., 2017; Engel, Claessens, & Finch, 2013). In contrast, social-emotional skills such as emotional understanding, self-regulation, and prosocial competence may have generalizable applicability across classrooms, and hence show alignment with most elementary school teacher expectations (Bassok, Latham, & Rorem, 2016). These speculations go well beyond the data presented in this study, but identify important issues that could be explored in future research.

In general, more follow-up studies are needed to understand the longer term benefits of the multiple approaches to SEL programming that currently characterize the preschool years (see reviews by Bierman & Motamedi, 2015; McClelland et al., 2017). For example, in addition to the use of SEL curriculum and professional development support for teachers, preschool interventions have also used organized games (e.g., Red Light, Purple Light; Schmitt, McClelland, Tominey, & Acock, 2015) and scaffolded pretend play (e.g., Tools of the Mind; Diamond, Barnett, Thomas, & Munro, 2007) to strengthen self-regulation skills. Further research that includes follow-up studies of these various approaches to preschool social-emotional support is needed to provide a stronger basis for understanding when and for whom sustained effects are most likely to occur.

## 8.2. Study limitations

One limitation of this study involves the use of teacher ratings as the sole measure of children's social-emotional functioning. The inclusion of additional methods of measurement would have strengthened the study. On the plus side, composites representing several measures provided broad indices of the targeted domains. Moreover, different teachers rated children each year. Teachers may approach these rating scales somewhat differently, potentially introducing personal rating biases and contributing to measurement invariance. At the same time, elementary school teachers had no way of knowing which children received the REDI intervention versus usual practice Head Start. Personal rating biases in teacher ratings may have attenuated the findings by introducing measurement error, but the use of multiple teacher ratings likely increased precision of measurement over the six years of the study.

Those teacher ratings allow for only relative comparisons between intervention and control groups; they do not provide an indication of children's skill levels compared to a normative standard. Hence, one cannot determine whether children in the REDI condition were below average, average, or above average, in their social skills at the end of the intervention, or whether their skills remained low relative to most other children in their grade or age group. Future research could include measures that would allow for normative comparisons over time for both intervention and control group children.

We were unable to use teacher ratings collected at baseline as pretreatment covariates when modeling later program outcomes. This was because teachers were trained during the summer and initiated the intervention from the first day of Head Start, before they knew children well enough to rate them. Instead parent ratings were used as baseline covariates. Although this is a limitation of the design, the study findings are likely robust, given the randomized controlled design and the lack of intervention-control group differences on any of the other baseline measures.

Finally, it remains unclear whether REDI would have attained the same intervention effects on children's social-emotional functioning if it had focused on that domain alone, using Preschool PATHS without the additional intervention components of interactive reading, sound games, and alphabet center. Because REDI used books that had themes aligned with PATHS for daily interactive reading, children received a particularly high level of exposure to discussions of social-emotional topics, dispersed across multiple contexts. The added focus of an interactive reading program on oral language skills and narrative comprehension may also have boosted some aspects of social-emotional functioning by enhancing language development (see Nix et al., 2013). The present design in which REDI was tested as a multi-component program does not provide a basis for determining the specific mechanisms of action within the intervention that account for the sustained effects.

## 8.3. Future directions

Additional follow-up assessments are needed to determine whether the sustained effects of REDI throughout elementary school will continue as children enter their adolescent years. After 5th grade, most children in the United States (and in this study) face a critical developmental transition as they complete elementary school and transition into early adolescence and the challenges of middle school (Graber & Brooks-Gunn, 1996). This transition can be particularly challenging for low-income children, who are often at elevated risk for a host of negative adolescent outcomes including substance use, early sexual activity, delinquency, truancy, and school dropout (Graber & Brooks-Gunn, 1996).

Social-emotional and self-regulation skills may play a critical role in supporting children as they make this transition, reducing their susceptibility to impulsive decision-making and thereby reducing initiation of these risky behaviors (Rudolph, Lambert, Clark, & Kurlakowsky, 2001). In addition, youth who are able to connect in positive ways with teachers as well as peers and who are actively engaged in learning are more likely to remain in school, complete additional levels of education, and attain more fruitful employment (Archambault et al., 2009; Zarrett & Eccles, 2006). Hence, it is possible that the social-emotional competencies produced by REDI and sustained throughout elementary school will enhance student school adjustment and reduce student risk through the transition into middle school and through adolescence.

## 8.4. Implications for practice and policy

Several recent studies have highlighted the importance of early social-emotional skills for long-term positive adaptation. For example, prosocial behavior assessed in kindergarten predicts early adult educational attainment, employment, mental health, substance use, and criminal activity (Jones et al., 2015). Likewise, self-control skills in preschool predict later financial well-being, physical health, decreased substance use, and criminal activity (Moffitt et al., 2011). Faced with many mandates and limited time and resources, many early childhood programs experience ambivalence and uncertainty regarding whether to emphasize social-emotional learning skills at the expense of cognitive and



academic competencies. The REDI intervention demonstrates that time spent on social-emotional learning in preschool can have sustained benefits in core areas of social-emotional functioning, and can be done in a way that supports academic learning (Nix et al., 2013) without displacing other important and mandated program components. The findings from the Head Start REDI intervention document that investing in social-emotional learning and academic programming is not an “either/or” proposition: Effectively integrated evidence-based curriculum components can facilitate development in both domains (Bierman et al., 2008a; Bierman, Nix, et al., 2008b; Bierman et al., 2014), with sustained benefits for children.

Although the REDI intervention was evaluated in the context of Head Start, it was not designed to be specific to that context. The theoretical model assumes that REDI differentially benefits economically disadvantaged children at risk for low readiness due to poverty. Such children are often served in other early childhood contexts, including public pre-K programs and subsidized child care. It is likely both the evidence based curriculum components and the support and professional development for implementing teachers could be successfully delivered in these settings, providing additional opportunities to boost the school readiness of low income preschoolers.

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## References

- Adams, M. J., Foorman, B. R., Lundberg, I., & Beeler, T. (1998). *Phonological sensitivity in young children: A classroom curriculum*. Baltimore: Paul H. Brookes Publishing Co.
- Archambault, I., Janosz, M., Morizot, J., & Pagani, L. (2009). Adolescent behavioral, affective, and cognitive engagement in school: Relationship to dropout. *Journal of School Health, 79*, 408–415.
- Bailey, D., Duncan, G. J., Odgers, C. L., & Yu, W. (2017). Persistence and fadeout in the impacts of child and adolescent interventions. *Journal of Research on Educational Effectiveness, 10*, 7–39.
- Barnett, W. S., & Carolan, M. E. (2014). *Facts about fadeout: The research base on long-term impacts of high quality pre-K (CEELO FastFact)*. New Brunswick, NJ: Center on Enhancing Early Learning Outcomes.
- Bassok, D., Latham, S., & Rorem, A. (2016). Is kindergarten the new first grade? *AERA Open, 1*, 1–31.
- Bassok, D., Gibbs, C., & Latham, S. (2017). Do the effects of early childhood interventions systematically fade? Exploring variation in the association between preschool participation and early school outcomes. Retrieved June 16, 2018 from: <http://curry.virginia.edu/uploads/resourceLibrary/36.Preschool.Fade.Out.pdf>
- Bierman, K. L., & Motamedi, M. (2015). Social-emotional programs for preschool children. In J. Durlak, C. Domitrovich, R. P. Weissberg, T. Gullotta, & P. Goren (Eds.), *The handbook of social and emotional learning: Research and practice* (pp. 135–150). New York: Guilford.
- 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*, 1802–1817.
- Bierman, K. L., Nix, R. L., Greenberg, M. T., Blair, C., & Domitrovich, C. E. (2008). Executive functions and school readiness intervention: Impact, moderation, and mediation in the Head Start REDI Program. *Development and Psychopathology, 20*, 821–843.
- Bierman, K. L., Nix, R. L., Heinrichs, B. S., Domitrovich, C. E., Gest, S. D., Welsh, J. A., & Gill, S. (2014). Effects of Head Start REDI on children's outcomes 1 year later in different kindergarten contexts. *Child Development, 85*, 140–159.
- Bierman, K. L., Heinrichs, B. S., Welsh, J. A., Nix, R. L., & Gest, S. D. (2017). Enriching preschool classrooms and home visits with evidence-based programming: Sustained benefits for low-income children. *Journal of Child Psychology and Psychiatry, 58*, 129–137.
- Blair, C. (2002). School readiness: Integrating cognition and emotion in a neurobiological conceptualization of children's functioning at school entry. *American Psychologist, 57*(2), 111.
- Blair, C., & Raver, C. C. (2015). School readiness and self-regulation: A developmental psychobiological approach. *Annual Review of Psychology, 66*, 711–713.
- Bradley, R. H., & Corwyn, R. F. (2002). Socioeconomic status and child development. *Annual Review of Psychology, 53*, 371–399.
- Brooks-Gunn, J., & Markman, L. B. (2005). The contribution of parenting to ethnic and racial gaps in school readiness. *The Future of Children, 139*–168.
- Burnham, K. P., & Anderson, D. R. (2002). *Model selection and multimodel inference: A practical information-theoretic approach* (2nd ed.). New York: Springer-Verlag.
- Campbell, F. A., Ramey, C. T., Pungello, E., Sparkling, J., & Miller-Johnson, S. (2002). Early childhood education: Young adult outcomes from the Abecedarian Project. *Applied Developmental Science, 6*, 42–57.
- Claessens, A., & Engel, M. (2013). How important is where you start? Early mathematics knowledge and later school success. *Teachers College Record, 115*(6), 1–29.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Mahwah, NJ: Lawrence Erlbaum.
- Conduct Problems Prevention Research Group. (1995). *Teacher Social Competence Scale Technical Report*. Retrieved September 18, 2016 from <http://www.fasttrackproject.org>
- Crick, N. R. (1996). The role of overt aggression, relational aggression, and prosocial behavior in the prediction of children's future social adjustment. *Child Development, 67*, 2317–2327.
- Deming, D. (2009). Early childhood intervention and life-cycle skill development: Evidence from Head Start. *American Economic Journal: Applied Economics, 1*, 111–134.
- Denham, S. A., & Burton, R. (2003). *Social and emotional prevention and intervention programming for preschoolers*. New York: Kluwer Academic/Plenum.
- Denham, S. A., Zinsler, K. M., & Brown, C. A. (2012). The emotional basis of learning and development in early childhood education. In B. Spodek, & O. Saracho (Eds.), *Handbook of research on the education of young children* (pp. 67–88). New York: Erlbaum.
- Diamond, A., Barnett, W. S., Thomas, J., & Munro, S. (2007). Preschool program improves cognitive control. *Science, 318*(5855), 1387–1388.
- Domitrovich, C. E., Cortes, R., & Greenberg, M. T. (2007). Improving young children's social and emotional competence: A randomized trial of the preschool PATHS curriculum. *Journal of Primary Prevention, 28*, 67–91.
- DuPaul, G. J. (1991). Parent and teacher ratings of ADHD symptoms: Psychometric properties in a community-based sample. *Journal of Clinical Child and Adolescent Psychology, 20*, 245–253.
- Durlak, J. A., Weissberg, R. P., Dymnicki, A. B., Taylor, R. D., & Schellinger, K. B. (2011). The impact of enhancing students' social and emotional learning: A meta-analysis of school-based universal interventions. *Child Development, 82*(1), 405–432.
- Engle, P. L., & Black, M. M. (2008). The effect of poverty on child development and educational outcomes. *Annals of the New York Academy of Sciences, 1136*, 243.
- Engel, M., Claessens, A., & Finch, M. A. (2013). Teaching students what they already know? The (mis)alignment between mathematics instructional content and student knowledge in kindergarten. *Educational Evaluation and Policy Analysis, 35*, 157–178.
- Evans, G. W., & Rosenbaum, J. (2008). Self-regulation and the income-achievement gap. *Early Childhood Research Quarterly, 23*(4), 504–514.
- Evans, G. W., & Kim, P. (2013). Childhood poverty, chronic stress, self-regulation, and coping. *Child Development Perspectives, 7*, 43–48.
- Feingold, A. (2013). A regression framework for effect size assessments in longitudinal modeling of group differences. *Review of General Psychology, 17*, 111–121.
- Graber, J. A., & Brooks-Gunn, J. (1996). Transitions and turning points: Navigating the passage from childhood through adolescence. *Developmental Psychology, 32*, 768–776.
- Greenberg, M. T. (2006). Promoting resilience in children and youth: Preventive interventions and their interface with neuroscience. *Annals of the New York Academy of Sciences, 1094*, 139–150.
- Hamre, B. K., Pianta, R. C., Mashburn, A. J., & Downer, J. (2012). Promoting young children's social competence through the Preschool PATHS Curriculum and MyTeachingPartner professional development resources. *Early Education and Development, 23*, 809–832.
- Hair, N. L., Hanson, J. L., Wolfe, B. L., & Pollak, S. D. (2015). Association of child poverty, brain development, and academic achievement. *JAMA Pediatrics, 169*(9), 822–829.
- Heckman, J., Pinto, R., & Savelyev, P. (2013). Understanding the mechanisms through which an influential early childhood program boosted adult outcomes. *The American Economic Review, 103*(6), 2052–2086.
- Institute of Educational Sciences. (2017). *What works clearinghouse procedures and standards handbook version 4.0*. Retrieved June 16, 2018: <https://ies.ed.gov/ncee/wwc/Docs/referenceresources/wwc.procedures.handbook.v4.pdf>
- Izard, C., King, K. A., Trentacosta, C. J., Morgan, J. K., Laurenceau, J., Krauthamer-Ewing, E. S., & Finlon, K. J. (2008). Accelerating the development of emotion competence in Head Start children: Effects on adaptive and maladaptive behavior. *Development and Psychopathology, 20*, 369–397.
- Jenkins, J. M., Duncan, G., Auger, A., Bitler, M., Domina, T., & Burchinal, M. (2018). Boosting school readiness: Should preschool teachers target skills or the whole child? *Economics of Education Review, 65*, 107–125.
- Jones, D. E., Greenberg, M. T., & Crowley, D. M. (2015). Early social-emotional functioning and public health: The relationship between kindergarten social competence and future wellness. *American Journal of Public Health, 105*, 2283–2290.
- Kohl, G. O., Lengua, L. J., McMahon, R. J., & the Conduct Problems Prevention Research Group. (2000). Parent involvement in school: Conceptualizing

- multiple dimensions and their relations with family and demographic risk factors. *Journal of School Psychology*, 38, 501–523.
- Ladd, G., & Profilet, S. (1996). The Child Behavior Scale: A teacher report measure of young children's aggressive, withdrawn, and prosocial behaviors. *Developmental Psychology*, 32, 1008–1024.
- Lonigan, C. J., Farver, J. M., Phillips, B. M., & Clancy-Menchetti, J. (2011). Promoting the development of preschool children's emergent literacy skills: A randomized evaluation of a literacy-focused curriculum and two professional development models. *Reading and Writing*, 24, 305–337.
- Lowenstein, A. E. (2011). Early care and education as educational panacea: What do we really know about its effectiveness? *Educational Policy*, 25, 92–114.
- Lynch, K. B., Geller, S. R., & Schmidt, M. G. (2004). Multi-year evaluation of the effectiveness of a resilience-based prevention program for young children. *The Journal of Primary Prevention*, 24, 335–353.
- Magnuson, K. A., Ruhm, C., & Waldfogel, J. (2007). The persistence of preschool effects: Do subsequent classroom experiences matter? *Early Childhood Research Quarterly*, 22, 18–38.
- McClelland, M. M., Acock, A. C., & Morrison, F. J. (2006). The impact of kindergarten learning-related skills on academic trajectories at the end of elementary school. *Early Childhood Research Quarterly*, 21(4), 471–490.
- McClelland, M. M., Tominey, S. L., Schmitt, S. A., & Duncan, R. (2017). SEL interventions in early childhood. *The Future of Children*, 27(1), 33–47.
- McNeish, D., & Matta, T. (2017). Differentiating between mixed-effects and latent-curve approaches to growth modeling. *Behavior Research Methods*.
- Moffitt, T. E., Arseneault, L., Belsky, D., Dickson, N., Hancox, R. J., Harrington, H., . . . , & Caspi, A. (2011). A gradient of childhood self-control predicts health, wealth, and public safety. *Proceedings of the National Academy of Science*, 108, 2693–2698.
- Morris, P. A., Millenky, M., Raver, C. C., & Jones, S. (2013). Does a preschool social-emotional intervention pay off for classroom instruction and children's behavior and academic skills? Evidence from the Foundations of Learning Project. *Early Education and Development*, 24(7), 1020–1042.
- Morris, P., Mattera, S. K., Castells, N., Bangser, M., Bierman, K., & Raver, C. (2014). *Impact findings from the Head Start CARES demonstration: National evaluation of three approaches to improving preschoolers' social and emotional competence. OPRE Report 2014-44*. Washington, DC: Office of Planning, Research and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services.
- Nix, R. L., Bierman, K. L., Domitrovich, C. E., & Gill, S. (2013). Promoting preschool social-emotional skills with the Head Start REDI Program enhances academic and behavioral outcomes in kindergarten. *Early Education and Development*, 24, 1000–1019.
- Paris, S. G. (2005). Reinterpreting the development of reading skills. *Reading Research Quarterly*, 40(2), 184–202.
- Pianta, R. C. (2001). *Student-teacher relationship scale: Professional manual*. Lutz, FL: Psychological Assessment Resources.
- Preschool Curriculum Evaluation Research Consortium. (2008). *Effects of preschool curriculum programs on school readiness (NCER 2008–2009)*. Washington, DC: National Center for Education Research, Institute of Education Sciences, U.S. Department of Education. Washington, DC: U.S. Government Printing Office.
- Raver, C., & Knitze, J. (2002). Ready to enter: What research tells policymakers about strategies to promote social and emotional school readiness among 3 and 4 years olds. In *National center for children in Poverty*. New York, NY, USA: Columbia University.
- Raver, C. C., Jones, S. M., Li-Grining, C., Zhai, F., Metzger, M. W., & Solomon, B. (2009). Targeting children's behavior problems in preschool classrooms: A cluster-randomized controlled trial. *Journal of Consulting and Clinical Psychology*, 77, 302–316.
- Reynolds, A. J., Magnuson, K., & Ou, S. (2010). Preschool-to-third grade programs and practices: A review of the research. *Children and Youth Services Review*, 32, 1121–1131.
- Riggs, N. R., Greenberg, M. T., Kusché, C. A., & Pentz, M. A. (2006). The mediational role of neurocognition in the behavioral outcomes of a social-emotional prevention program in elementary school students: Effects of the PATHS Curriculum. *Prevention Science*, 7, 91–102.
- Rudolph, K. D., Lambert, S. F., Clark, A. G., & Kurlakowsky, K. D. (2001). Negotiating the transition to middle school: The role of self-regulatory processes. *Child Development*, 72, 929–946.
- Ryan, R. M., Fauth, R. C., & Brooks-Gunn, J. (2006). Childhood poverty: Implications for school readiness and early childhood education. In B. Spodek, & O. N. Saracho (Eds.), *Handbook of research on the education of children* (2nd ed., pp. 323–346). Mahwah, NJ: Erlbaum.
- Schmitt, S. A., McClelland, M. M., Tominey, S. L., & Acock, A. C. (2015). Strengthening school readiness for Head Start children: Evaluation of a self-regulation intervention. *Early Childhood Research Quarterly*, 30, 20–31.
- Schweinhart, L. J., Montie, J., Xiang, Z., Barnett, W. S., Belfield, C. R., & Nores, M. (2005). Lifetime effects: The HighScope Perry Preschool Study through age 40. In *Monographs of the HighScope Educational Research Foundation*, 14. Ypsilanti, MI: HighScope Press.
- Singer, J. D., & Willett, J. B. (2003). *Applied longitudinal data analysis: Modeling change and event occurrence*. New York: Oxford University Press.
- Snyder, T. D., de Brey, C., & Dillow, S. A. (2016). *Digest of Education Statistics 2014 (NCES 2016-006)*. Washington, DC: National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education.
- Upshur, C. C., Heyman, M., & Wenz-Gross, M. (2017). Efficacy trial of the Second Step Early Learning (SSEL) curriculum: Preliminary outcomes. *Journal of Applied Developmental Psychology*, 50, 15–25.
- Wasik, B. A., Bond, M. A., & Hindman, A. (2006). The effects of a language and literacy intervention on Head Start children and teachers. *Journal of Educational Psychology*, 98, 63–74.
- Webster-Stratton, C., Reid, M. J., & Hammond, M. (2001). Preventing conduct problems, promoting social competence: A parent and teacher training partnership in Head Start. *Journal of Clinical Child & Adolescent Psychology*, 30, 283–302.
- Werthamer-Larsson, L., Kellam, S., & Wheeler, L. (1991). Effect of first-grade classroom environment on shy behavior, aggressive behavior, and concentration problems. *American Journal of Community Psychology*, 19, 585–602.
- Yoshikawa, H., Weiland, C., Brooks-Gunn, J., Burchinal, M. R., Espinosa, L. M., Gormley, W. T., . . . , & Phillips, M. D. (2013). *Investing in our future: The evidence base on preschool education* (Vol. 9) Ann Arbor, Michigan: Society for Research in Child Development.
- Zarrett, N., & Eccles, J. (2006). The passage to adulthood: Challenges of late adolescence. *New Directions for Youth Development*, 13–28.