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Enhancing Early Child Care Quality and Learning for Toddlers at Risk: The Responsive Early Childhood Program

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Despite reports of positive effects of high-quality child care, few experimental studies have examined the process of improving low-quality center-based care for toddler-age children. In this article, we report intervention effects on child care teachers' behaviors and children's social, emotional, behavioral, early literacy, language, and math outcomes as well as the teacher–child relationship. The intervention targeted the use of a set of responsive teacher practices, derived from attachment and sociocultural theories, and a comprehensive curriculum. Sixty-five childcare classrooms serving low-income 2- and 3-year-old children were randomized into 3 conditions: business-as-usual control, Responsive Early Childhood Curriculum (RECC), and RECC plus explicit social–emotional classroom activities (RECC+). Classroom observations showed greater gains for RECC and RECC+ teachers' responsive practices including helping children manage their behavior, establishing a predictable schedule, and use of cognitively stimulating activities (e.g., shared book reading) compared with controls; however, teacher behaviors did not differ for focal areas such as sensitivity and positive discipline supports. Child assessments demonstrated that children in the interventions outperformed controls in areas of social and emotional development, although children's performance in control and intervention groups was similar for cognitive skills (language, literacy, and math). Results support the positive impact of responsive teachers and environments providing appropriate support for toddlers' social and emotional development. Possible explanations for the absence of systematic differences in children's cognitive skills are considered, including implications for practice and future research targeting low-income toddlers.

Keywords: child care, early intervention, school readiness

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Early childhood is a sensitive period for exposure to quality learning environments as environmental influences during this period impact brain development, learning, behavior, and physical and mental health throughout life (e.g., Elman et al., 1996). One environment where 24% of U.S. children under age 4 with employed mothers spend many hours is child care centers (Federal Interagency Forum on Child and Family Statistics, 2011). Improving quality of child care experiences is critical given reports of the sustained positive effects of exposure to higher quality child care (e.g., Peisner-Feinberg et al., 2001). Unfortunately, children in poverty are likely to spend many hours each day in low-quality childcare (National Institute of Child Health and Human Development (NICHD) Early Childcare Research Network, 2000) and are likely to receive inadequate home supports because of parents' own life stresses and limited resources (e.g., Conger, McCarty, Yang, Lahey, & Kropp, 1984; Hammond, Landry, Swank, & Smith, 2000). Thus, children who can least afford to fall behind are most likely *not* to receive the kinds of care that promote brain development and superior outcomes (Duncan, Brooks-Gunn, & Klebanov, 1994).

Given the importance of early experiences and that low-income families tend to rely on child care based in centers that accept subsidies (Fuller, Holloway, & Liang, 1996), the present study sought to enhance responsive caregiving in center-based child care where a minimum of 50% of enrolled children attended using federal or state welfare-to-work subsidies. In 2011, about $5 billion was spent on federal child care subsidies, but only 2% of these funds were used to improve quality of child care services for infants and toddlers (U.S. Department of Health and Human Services, 2011). Accordingly, child care quality varies substantially, but the majority (86%) is mediocre to low quality (Helburn, 1995), including overcontrolling care that is associated with increases in child cortisol levels as well as anxiety and aggression (Gunnar, Kryzer, VanRyzin, & Phillips, 2010). Additionally, the complex requirements for families utilizing child care subsidies result in many eligible parents losing subsidies temporarily as they meet certification requirements (Adams, Snyder, & Sanfort, 2002). This instability is coupled with annual child care staff turnover rates of between 30% and 37%, rivaling only the turnover rates of the fast food industry; high child care teacher turnover is related to low wages, limited training, and instability in child care leadership (Helburn & Howes, 1996; Whitebook & Sakai, 2003).

Limits of Existing Approaches to Ensuring School Readiness

Seminal studies have demonstrated sustained effects of high-quality center-based environments during the preschool years on children's longitudinal cognitive and social–emotional outcomes measured at school age (e.g., Ramey & Ramey, 1998; Schweinhart, Barnes, & Weikart, 1993). But landmark studies, such as the Abecedarian Project, relied on highly trained teachers and comprehensive services that can be difficult to replicate in typical child care centers serving low-income children. Indeed, state- and federally funded pre-kindergarten (pre-K) programs for 3- to 5-year-olds (U.S. Department of Health & Human Services, 2001, 2010) as well as toddler programs for 2- and 3-year-olds (Vogel, Xue, Moiduddin, Kisker, & Carlson, 2010) often fail to produce sustained effects on children's school-age outcomes because of poor quality or inadequate implementation of effective practices. Enhancing the quality of child care programs for disadvantaged toddlers is likely a good investment that prepares children to take optimal advantage of pre-K programs, thereby promoting school readiness (Heckman, 2006). However, there is a dearth of information on effective intervention models that target typical child care staff who have limited training, are working for low wages, and are employed in centers with high turnover. Such models would need to address common problems in child care centers serving low-income children, including low levels of teacher responsiveness to children's signals, rich language input, cognitively stimulating activities, and predictable schedules (Coley, Li-Grining, & Chase-Lansdale, 2006).

An Early Intervention Designed for Child Care Centers Serving Disadvantaged Children

To address this gap, we developed a professional development and curriculum intervention with the primary goal of enhancing center-based, child care teachers' ability to use *responsive teacher–child interactions* with 2- and 3-year-olds. We defined *responsive teacher behaviors* as those promoting children's development of both (a) social and emotional skills (e.g., supports to regulate behavior) and (b) linguistic and cognitive skills (e.g., rich language input or scaffolded introduction to early math concepts; e.g., Landry, Smith, Swank, Assel, & Vellet, 2001; Starkey, Klein, & Wakeley, 2004; Tamis-LeMonda, Bornstein, & Baumwell, 2001). This responsive, intentional approach to caring for young children trained child care teachers to use strategies proven effective in a random assignment intervention with parents in home settings, called Play and Learning Strategies (Landry et al., 2012; Landry, Smith, & Swank, 2006; Landry, Smith, Swank, & Guttentag, 2008), which is grounded in the attachment and the sociocultural theories (Ainsworth, Blehar, Waters, & Wall 1978; Vygotsky, 1978).

Theory of Change for the Intervention

Responsive caregiving across different theoretical frameworks includes such things as providing emotional support, offering reciprocal communication, accepting the need for growing independence, and providing cognitive stimulation that scaffolds the young child's early learning (e.g., Ainsworth, et. al. 1978; Olson, Bates, & Bayles, 1984). Contingent responsiveness, in the attachment framework, has been described as a chain of events where the child signals, the caregiver responds promptly and sensitively, and the child experiences a positive outcome that ultimately builds trust and promotes a willingness to cooperate (Ainsworth et al., 1978; Bornstein & Tamis-LeMonda, 1989). Within the sociocultural framework, caregivers provide "other regulation" through interactive behaviors that scaffold children's ability to develop core linguistic and cognitive skills that prepare them for formal schooling (e.g., Bakeman & Adamson, 1984; Tomasello, 1988). Responsive adult behaviors that predict faster rates of social, cognitive, and linguistic development include maintaining and building on children's interests with rich language input, rather than redirecting (Landry, Swank, Smith, Assel, & Gunnewig, 2006; Tomasello, 1988; Yoder, Davies, Bishop, & Munson, 1994), and conversational responsivity behaviors, such as looking expec-

tantly at children as they speak and recasting a child's utterance into a more complete form (e.g., Cabell et al., 2011; Girolametto, Weitzman, & Greenberg, 2003; Yoder & Warren, 2002). Although representing different theoretical frameworks (i.e., attachment, sociocultural, linguistic), there is experimental evidence that a constellation of responsive caregiver behaviors produces a responsive style that mediates enhanced toddlers' outcomes (Landry et al., 2008).

Thus, the intervention in the present report encouraged child care staff to respond contingently to children's signals and to incorporate their use of age-appropriate, cognitively stimulating activities (e.g., language, early literacy, and math). These responsive, positive interactions with the teacher were the expected mechanism to provide (a) a secure base for exploration, (b) supports to develop behavior regulation skills for coping with novelty and potential stress in the environment, and (c) scaffolds to engage more fully in social interactions and learning activities. In addition to the expected positive effect of responsive teacher practices on children's social, emotional, and cognitive skills, we also expected that the increased responsivity would result in the children forming a closer relationship with their teacher and showing lower levels of behavioral and emotional problems (e.g., anxiety, aggression).

Professional Development on Responsivity in Preschool and Toddler Classrooms

Our intervention components were derived from responsivity theory as well as experimental and quasi-experimental studies in which responsive adult behaviors were facilitated through professional development or curriculum supports. Although there have been many experimental studies in which parents have been trained in responsive practices (e.g., Landry et al., 2008; Yoder & Warren, 2002), fewer experiments have involved training teachers. Further, most classroom studies focused on pre-K rather than toddler classrooms and on narrow aspects of responsivity, such as conversational responsivity. Even so, research with pre-K teachers has shown increases in targeted teacher practices when professional development included (a) trainings that follow principles of effective adult learning models (Bransford, Brown, & Cockring, 2000), such as use of exemplar video and small-group interactions to ensure teachers feel part of a community of learners, and (b) individualized, in-class coaching (Girolametto et al., 2003; Landry, Swank, et al., 2006; Powell, Diamond, Burchinal, & Koehler, 2010) or remote coaching and feedback (Cabell et al., 2011; Pianta, Mashburn, Downer, Hamre, & Justice, 2008). In one experiment in Canada with two toddler teachers and 14 pre-K teachers and their young students (18–67 months old), a 14-week conversational responsivity intervention showed impacts on some responsive teacher behaviors (*d*s = 0.30–0.80), quality of language input (*d*s = 1.20–1.50), and children's quantity of utterances, multiword utterances, and peer-directed talk (*d*s = 0.80–1.50; Girolametto et al., 2003). This suggests training and coaching on responsivity behaviors can support teachers of young children.

Curricular supports can also provide an efficient method for improving classroom practices through provision of a systematic scope and sequence of activities. For example, pre-K teachers have been supported in use of effective teaching strategies when provided curricula that include hands-on language and literacy activities (Bierman et al., 2008; Wasik, Bond, & Hindman, 2006) and early mathematics activities (Starkey et al., 2004). A comprehensive curriculum was provided in the present study for several reasons. First, this facilitated instruction in early language, literacy, mathematics, and social–emotional skills that tend to be weak for low-income children (Institute of Education Sciences, National Center for Education Statistics, 2003; Zill & West, 2001). Second, to address the problem in many child care centers serving low-income children of unpredictable routines that support self-regulation, the curriculum put a schedule of daily activities in place that balanced adult-guided and child-centered learning activities (Vygotsky, 1978). Third, for integration and retention of this new information, curriculum units were designed to present repeated and varied experiences around a topic within close time proximity (Rovee-Collier, 1995).

Explicit Social–Emotional Curriculum Supplement

During the toddler and preschool periods, there is tension between desires for independence and dependence that often results in problem behaviors (tantrums, biting) that may be due, in part, to children's relatively limited language skills (e.g., Tervo, 2007). Teachers can be trained to avoid an intrusive style that interferes with a supportive relationship and to support children in learning emotion vocabulary, making appropriate choices, and learning to delay gratification (e.g., Eisenberg, Cumberland, & Spinrad, 1998; Grusec & Goodnow, 1994). A scaffolded, playful cognitive curriculum can enhance 4-year-olds' self-regulation skills (Barnett et al., 2008), but it is not known whether disadvantaged 2- and 3-year-olds benefit sufficiently from a global, but rather implicit, approach of using a responsive style to support social–emotional skills or if they require more direct supports. Therefore, one condition of the present study included a simple social–emotional curriculum supplement (and minimal training) to explore the effects of more explicit instruction on regulating emotions and building social skills for positive adult and peer interactions.

Research Questions and Hypotheses

This randomized control trial examined the effectiveness of a professional development and curriculum intervention, called Responsive Early Childhood Curriculum (RECC), for improving a broad array of child outcomes. Child care teachers with toddlers (2- to 3-year-olds) in their classrooms were randomized (one per building site) to one of three conditions: a business-as-usual control, RECC, and RECC plus an explicit set of activities to build social–emotional skills (RECC+). Three research questions were addressed:

1. To what extent does training in a constellation of responsive practices and curriculum improve the quality of teacher–child interactions and classroom instructional activities?

2. To what extent do the interventions produce greater gains in children's social and emotional competence, language, early literacy, and early mathematical knowledge, as well as positive teacher–child relationships?

3. To what extent are effects of the interventions on child outcomes mediated by changes in teachers' behaviors?

This study differs from prior research in important ways: (a) Few extant experimental studies focused exclusively on the toddler period have trained a relatively large sample of child care teachers (n = 65); (b) participating children primarily came from low-income backgrounds, and many attended child care using welfare-to-work subsidies; (c) the intervention employed professional development and comprehensive curricular supports of relatively high intensity to attempt to improve teaching practices within often unstable child care environments; and (d) the design contrasted an implicit and explicit approach to supporting social–emotional skills during a sensitive developmental period for these abilities. We hypothesized that compared with control teachers, teachers in both the RECC and the RECC+ conditions would demonstrate greater gains in responsive practices such as sensitivity, language, early literacy, mathematics, and classroom organization. We expected that the children whose teachers were in the intervention conditions would make greater gains in all skill domains compared with children in the control condition. We expected RECC+ teachers would show greater gains in sensitivity practices and that their students would have great increases in social–emotional outcomes compared with the RECC and control groups, due to their additional curricular focus on social–emotional competence. Finally, we anticipated that observed changes in teacher practices would mediate improvements in child outcomes, thereby revealing mechanisms underlying children's development.

Method

Participants

Recruitment and assignment. Child care centers were recruited across 3 years to participate in this multisite project. We used Internet search engines to canvas websites (e.g., Department of Family and Protective Services) to generate local lists of child care centers accepting federal or state child care subsidies. Each year, approximately 65 to 100 child care centers were contacted to ascertain interest and eligibility. Child care eligibility criteria were that the center must have (a) a full-day, 2- and/or 3-year-old classroom and (b) at least 50% of children receiving child care subsidies. One classroom per child care center participated, resulting in a total of 65 classrooms (34 in Texas, 31 in Florida; distribution by condition in the online Appendix A). Informed consent was obtained, and classes were randomly assigned to one of three conditions: (a) business-as-usual control, (b) RECC curriculum and training, or (c) RECC+ with the add-on explicit social curriculum. Each cohort of classes was assigned using a randomized block procedure: in Florida, stratified assignment balanced for percentage of minority students across conditions, and in Texas, stratified assignment balanced for percentage of students receiving subsidy. The different randomization approaches were important because Florida had greater variability in ethnicity of students, whereas Texas had greater variability in students receiving subsidies (range = 50%–100%).

Demographics and background. Descriptive statistics characterizing the sample are in Table 1. Mandated local staff to child ratios were 1:11 for 2-year-olds and 1:15 for 3-year-olds, resulting in an average class size of 12 children (SD = 3.80; range = from six to 21). Instruction was delivered in English by teachers with a range of 0–35 years of teaching experience and typically a high school degree (see Table 1). Teacher ethnicity, years of teaching experience, and education did not significantly differ between groups at pretest. After obtaining informed consent from parents, experimenters randomly selected approximately eight children from each classroom to participate in assessments (n = 542). Children's pretest language scores were below national norms (M = 91.2, SD = 15.5) on the Preschool Language Scale-4 (PLS-4; Zimmerman, Steiner, & Pond, 2002). Groups did not significantly differ on child gender, age, or ethnicity at pretest.

Attrition. During the study, five classrooms (two control, one RECC, and two RECC+) exited the study. Reasons for leaving varied (e.g., center closed due to hurricane damage; center/classroom closed), but one RECC+ center withdrew because they could not meet the study requirements. These classrooms were excluded from analyses. There is often high teacher turnover in child care settings (Whitebook & Sakai, 2003). In this study, 43% of classrooms experienced teacher turnover during the academic year (see Table 1 note). Teachers reported various reasons for exiting the study (e.g., health issues, employment termination). Attrition was evenly distributed across conditions of the study—11 control and nine treatment teachers exited (see online Appendix A). Comparison of teachers who exited with those who stayed yielded no significant differences on the Teacher Behavior Rating Scale (TBRS, described later; Landry, Crawford, Gunnewig, & Swank, 2000) at pretest, Fs (1, 43–64) = 0.0–1.54, ns. Replacement teachers were appointed by the child care center and were invited to participate in the study. Coaches conducted double sessions to "catch-up" and train replacement teachers on the intervention content so children did not experience a lapse in the intervention. Considerable child attrition (26%) was also experienced (see Table 1). For all measures, Wave 1 scores were examined for differences between children who exited the study and those with complete data. Significant differences were found for the child math assessment, $F(1, 206) = 52.0$, $p < .001$, and Test of Preschool Early Literacy (TOPEL)–Print Knowledge (Lonigan, Wagner, Torgesen, & Rashotte, 2007), $F(1, 256) = 7.0$, $p < .01$, with children who dropped out of the study having lower scores than their counterparts who stayed in the study.

Coach characteristics and procedures. Coaches were selected to include individuals with both previous experience teaching (M = 6.33 years; median = 3 years; range = 0–20), working as coaches in preschool or parenting interventions (M = 1.22 years of coaching experience; range = 0–4 years). Coaches were systematically trained to deliver the intervention by the principal investigator and supervisor. Coaches worked with three or four intervention teachers, depending on whether coaches were full- or part-time employees. At each site, two or three coaches delivered the intervention each academic year with some changes in coaching staff for Cohorts 2 and 3 (Texas trained five coaches, Florida trained four). All coaches had a minimum of a bachelor's degree (n = 3), five held master's degrees, and one held a Ph.D.; most majored in education or a related field. Several techniques were used to ensure coaches' fidelity and consistency of implementation across the sites, including (a) biweekly cross-site conference calls with all project staff and the principal investigator; (b) bimonthly cross-site newsletters featuring curriculum topics and child care

Table 1
Descriptive Statistics for Participants Demographics

Variable	Classroom/teacher characteristics (n = 65 classes)	Child/caregiver characteristics (n = 542)
Female (%)	100	51
Mean age in years at pretest[a] (*SD*)		2.90 (0.59)
Ethnicity/race (%)		
African American	83.1	78.0
Hispanic/Latino	13.6	13.4
White	1.7	6.8
Multiracial	—	—
Other	1.7	1.9
Level of education (%)		
High school	1.7	16.5
High school/GED or technical training	48.3	34.6
High school + Child Development Associate credential	28.3	—
Some college but no degree	—	29.2
Associate's degree	13.3	7.5
Bachelor's degree	6.7	9.0
Master's degree	1.7	2.7
Doctoral degree	—	0.6
Mean no. of years of teaching experience in child care (*SD*)	9.0 (8.0)	
Assistance programs (% of children participating)		
Federal child care subsidy		65.0
Free/reduced price lunch		82.5
Dominant home language (%)		
English		93.0
Spanish		7.0
Mean no. of hours enrolled in child care per week (*SD*)		38.22 (26.03)
Locale[b] (%)		
Urban	84.6	
Rural	15.4	
No. of adults in classroom (% of classrooms)		
Single lead teacher	76.9	
Lead teacher and assistant	23.1	
Attrition (%)		
Lead teacher turnover from pre/post[c]	43.3	
Children with both pre/post data[d]		26.0

Note. GED = General Educational Development degree.
[a] Age calculated at Sept. 1 for all cohorts. [b] Rural defined as less than 7,000 inhabitants. [c] Attrition = 34 classrooms (56.67%) had no teacher turnover, 18 (30.00%) lost one, seven (11.67%) lost two to four, and one (1.67%) lost six teachers. [d] Of the original 542 children, 384 (71%) had pretest and posttest data, 140 (26%) had data only at pretest, and 18 children (3%) had data only at posttest.

teacher interviews; and (c) regularly scheduled classroom visits in which supervisors (who had several years of experience coaching teachers) provided individualized training to coaches.

Intervention Procedures and Curriculum Components

Child care teachers assigned to both intervention conditions (RECC or RECC+) received curriculum manuals, all required curriculum materials, and monetary stipends ($200 for lead teacher and $100 for teacher assistants given three times per year). Teachers assigned to the control condition received no training or curriculum but did receive monetary stipends for submitting data ($100 two times per year) and also received a set of generic classroom materials (blocks, trucks, puppets, pretend food) as an incentive to participate.

Group training sessions. A 6-week "priming" training phase, including a 7-hour group training, occurred in the spring before the intervention began to allow teachers to practice the first curriculum unit prior to the start of full implementation in fall. Two more 7-hour trainings occurred in August, and a fourth training session lasting 6 hours occurred in January. Trainings included interactive discussion and role play; detailed training information is in online Appendix B. Lead teachers and assistants each received a $75 stipend for attending the first three trainings and a $50 stipend for attending the final training. Local coaches conducted equivalent trainings at the Texas and Florida sites. Trainings were identical across the two intervention conditions, except that RECC+ teachers stayed for an extra half-hour after one of the August and the January trainings days to receive and review the social–emotional curriculum supplement with their coach.

In-class coaching and training. In addition, lead teachers and, if applicable, assistants received weekly coaching support for 9 months (37 weeks). Coaches used a combination of 20 in-class coaching sessions and 19 didactic naptime sessions to help child care teachers enhance instruction. In-class coaching sessions (~2 hr) provided opportunities for individualized training and included (a) observing and providing immediate feedback, (b) modeling an instructional strategy or activity (e.g., using the letter wall or

responsive practices), (c) videotaping a segment of instruction to play back in next week's didactic visit, and (d) giving feedback on specific strengths, areas for improvement, and setting goals to focus on in the next week's activities.

Didactic in-class training sessions (1.5–2.0 hr) occurred during naptime to allow teachers and coaches to discuss progress and view training videos (topics in online Appendix B). Naptime sessions included five steps: (a) discussing the teachers' efforts to employ responsive behaviors and implement the curriculum, (b) discussing an educational video or reading and discussing an educational training handout, (c) critiquing the videotaped segment of instruction recorded in the previous week's in-class session, (d) setting goals, and (e) delivering and discussing upcoming curriculum and theme-related materials. For teachers assigned to the RECC+ condition, duration of didactic sessions was equal to the sessions for RECC teachers; however, about 5 min less time was spent on video playback to allow discussion of the current explicit social–emotional activities. Across both in-class and didactic sessions, coaches spent an average of 66 total hours (SD = 10; range = 49–95) in intervention classrooms for a total of 37 sessions; coaching hours did not differ across conditions (p = .30). There were five outlier classrooms receiving more than 80 hr of coaching because the sites required retraining of several teachers due to high teacher turnover.

Responsive Early Childhood Curriculum (RECC). The core Responsive Early Childhood Curriculum (RECC; Reed & Landry, 2006) was implemented by all intervention teachers alongside the responsive teaching practices adapted from a responsive parenting toddler intervention model (Landry et al., 2008). These trained responsiveness behaviors are hypothesized "active ingredients": (a) sensitively and promptly respond to child's signals; (b) use positive approaches to manage child behavior and support self-regulation; (c) label and help children cope with feelings; (d) help children resolve conflicts with peers; (e) use effective strategies for toddler challenges (e.g., sharing, tantrums, transitions); (6) provide rich language input; (7) maintain, rather than redirecting, children's focus of attention; and (8) scaffold children's learning by adjusting input upward or downward.

In addition to the responsive teaching style, a second hypothesized active ingredient was training RECC and RECC+ teachers to use developmentally appropriate cognitive readiness activities for 2.0–2.5 hr per day. Daily teacher-led cognitive activities included three whole-class circle times (two read alouds, nursery rhyme) and math small groups, in addition to independent center activities. RECC+ also included a daily social–emotional activity. The dose of four teacher-led cognitive activities per day for RECC or five for RECC+ was implemented 5 days per week across 36 weeks. Thus, the total intervention intensity (Dose × Frequency × Duration) was 720 RECC activities and 900 RECC+ activities. An eight-unit thematic approach gave repeated exposure to new concepts with connected books, songs, and activities. Parent newsletters were sent home at the beginning of each 4- to 6-week unit describing what children would learn.

Teachers were trained in interactive book-reading techniques and were provided after reading with extension activities to promote language skills (Fletcher & Reese, 2005). Playful activities supported print knowledge, such as adult modeling of writing in literacy-enriched play centers or tracking print when reading nursery rhymes (e.g., Justice, Pullen, & Pence, 2008). Emphasis was placed on helping children recognize their name in print (Treiman & Broderick, 1998) by using names throughout the classroom (e.g., on attendance chart, helper chart, letter wall). Early phonological awareness skills were targeted by using nursery rhymes to discuss rhyming words and clap syllables in words. Teachers were trained to use small-group activities adapted down from a pre-K math curriculum (Starkey et al., 2004), addressing skills such as counting and constructing small sets, pattern duplication, and shape recognition and production.

Explicit social–emotional curriculum (RECC+). Approximately one third of the sample (22 teachers) received additional training and materials to provide explicit instruction related to children's social and emotional development. Training topics focused on social and emotional competencies that are related to success in school (e.g., Denham, 1998; Graziano, 2007). RECC+ teachers were asked to include a daily explicit social–emotional lesson by conducting a fourth whole-class circle time across four units: (a) understanding feelings, (b) making friends, (c) building self-esteem, and (d) increasing self-competence. For each unit, between five and seven books and a menu of activities were provided, such as discussing emotions using photos of children with different facial expressions or stamps of different emotions (e.g., sad face, mad face).

Data Collection Procedures

Data collection included (a) child care teacher observation, (b) child care teacher questionnaires and ratings, (c) direct child assessments, and (d) fidelity observations.

Child care teacher observation. Observations of teaching quality (measure detailed later) were conducted before the priming training phase in April of academic year prior to child data collection. Then classroom observations were repeated three times during the academic year in which child data were collected in September, January, and April. Observations were 120–180 min. Observers were blind to the teachers' condition and underwent a systematic training procedure including (a) a 2-day training with a manual and video exemplars for all behaviors of interest, (b) practice group coding with six videos, (c) independent video coding with two videos, and (d)from three to five classroom coding sessions with a reliable coder. Trainees were required to achieve at least 80% agreement with the master coder to be considered reliable. Ongoing drift checks were conducted.

Child care teacher questionnaires. All child care teachers completed questionnaires to provide demographic information and information about their teaching practices before the start of the intervention. Additionally, lead teachers provided child ratings in the fall, at midyear, and in the spring about children's social–emotional functioning and relationship with the teacher.

Direct child assessments. Examiners were trained and monitored by doctoral-level project staff. Certified examiners demonstrated consistent and accurate administration on every task before collecting data. Child assessments occurred in centers, and examiners were blind to condition. Depending on the child's attention span, testing was conducted in four 30- to 45-min pull-out sessions. Assessments were conducted at three time points. Time 1 began in September (approximately 2–3 weeks after the intervention began) and continued through October. Time 2 was conducted

at midyear and occurred in January. Time 3, end-of-year assessments, were conducted in March and April.

Fidelity of teacher implementation. On a monthly basis, coaches rated RECC and RECC+ teachers' fidelity of intervention delivery, using a 5-point Likert scale (from *minimal* to *high*). Sixteen ratings measured responsive teaching practices and implementation of curriculum activities. A second 10-item monthly fidelity check assessed implementation of math small-group activities, with a scale from 0.00 to 1.00 (*low* < 0.70, *moderate* 0.71–0.89, *high* 0.90–1.00). Teachers' reports of informal math assessments were also used to determine the number of math activities implemented. Sample fidelity ratings and implementation statistics are detailed in online Appendix C. In summary, overall language and literacy curriculum implementation was rated as moderate; however, the explicit social–emotional activities (i.e., fourth circle time) were rated as occasional, and the quality of math activity implementation was low, despite teacher report of completing the majority (70%) of activities.

Measures

Child care teacher behaviors. The Teacher Behavior Rating Scale (TBRS; Landry et al., 2000) was used to evaluate change in teacher responsiveness and instruction. The TBRS contains 13 subscales with a total of 50 items that capture both quantity and quality of specific teaching behaviors as well as a total score (see Table 2 and more detailed information in online Appendix D). Interrater reliability was high, ranging from .71 to 1.00 (generalizability coefficients in Table 2) for 10% of observations that were conducted by two reliable coders for each cohort of teachers. The quantity and quality scores were highly correlated (total scores range for *r*s = .85–.88); therefore, an average score across quantity and quality was used in all analyses on a 4-point scale ranging from 1 (*low*) to 4 (*high*), such that scoring 2 (*medium low*) and 3 (*medium high*) still represents a fair amount of stimulation for students. To contextualize this for a specific subscale, scoring 2 (*medium low*) for learning centers indicates a range of materials in several centers (e.g., library, pretend play, construction, art); however, the center materials were typically not of high quality (e.g., lacking in visual appeal, or not age appropriate, or sparse) and were not linked to a theme, whereas a score of 3 (*medium high*) indicates center materials were more closely linked to thematic activities, materials were more appealing, and there was greater evidence that teachers helped children successfully engage with center materials. Classrooms that scored 4 (*high quality*) were quite appealing and well stocked with age-appropriate materials that were intimately tied to ongoing thematic activities.

Child emotional understanding. Knowledge of emotion was assessed with procedures originally designed by Izard (1971). However, Izard's procedures were adapted by Bullock and Russell (1985) in order to allow the task to be able to be used with children younger than age 3. This was accomplished by using only core emotions that are easily understandable by most children (e.g., angry, sad, happy, scared). Prior to the start of the current project, the items were piloted and deemed appropriate for low-income 2- and 3-year-olds. We assessed expressive, receptive, and situational understanding of emotions. *Expressive emotion understanding* was assessed with eight items showing pictures of children's faces depicting an angry, sad, happy, or scared expression and asking how each child felt (e.g., "Tell me how this child feels."). *Receptive emotion understanding* was measured with 20 items by showing a page with photos of two children's faces depicting different emotional expressions and asking the child to point to the photo representing a particular emotion (e.g., "Show me which one is happy."). To assess *situational emotion understanding*, an experimenter read the child 12 everyday vignettes that would elicit a particular emotion while presenting the child with four faces showing different emotions. After hearing the story, the child was asked to point to the emotion of how the child felt. Situational emotion understanding was conducted only at Times 2 and 3 because of the greater complexity of this task. Children received 2 points for each correct response and zero points for incorrect responses. Partial credit (1 point) was given for emotions with

Table 2
Teacher Behavior Rating Scales: Intervention Versus Control Effects and Effect Sizes

Subscale	r^e	Intervention *M (SD)*			Control *M (SD)*			*t*	*p*	Effect size
		Fall	Winter	Spring	Fall	Winter	Spring			
1. Classroom Community	.91	2.55 (0.62)	2.47 (0.61)	2.45 (0.60)	1.92 (0.79)	2.12 (0.71)	1.96 (0.60)	2.69	0.0088**	0.61
2. Sensitivity	.85	2.26 (0.55)	2.47 (0.55)	2.51 (0.56)	1.94 (0.85)	2.17 (0.60)	2.22 (0.54)	1.47	0.1455	0.29
3. Discipline	.85	2.31 (0.76)	2.51 (0.94)	2.46 (0.67)	2.16 (1.06)	2.29 (0.78)	2.58 (0.85)	0.13	0.8976	0.03
4. Learning Centers	.89	2.49 (0.80)	2.77 (0.77)	2.90 (0.65)	1.63 (0.67)	1.74 (0.67)	1.73 (0.79)	5.41	<.0001***	1.74
5. Oral Language	.96	2.21 (0.61)	2.38 (0.68)	2.56 (0.71)	1.71 (0.61)	1.83 (0.53)	2.07 (0.63)	2.62	0.0107*	0.79
6. Book Reading	.93	2.18 (0.64)	2.23 (0.59)	2.41 (0.69)	1.43 (0.41)	1.84 (0.32)	1.75 (0.50)	3.31	0.0014***	1.35
7. Written Expression	.71	1.15 (0.25)	1.31 (0.29)	1.31 (0.40)	1.09 (0.19)	1.06 (0.10)	1.14 (0.17)	2.87	0.0051**	1.23
8. Print and Letter	.96	1.60 (0.48)	2.10 (0.48)	1.98 (0.60)	1.35 (0.28)	1.49 (0.39)	1.47 (0.35)	3.85	0.0002***	1.35
9. Phonological Awareness	.92	1.16 (0.30)	1.22 (0.43)	1.38 (0.53)	1.22 (0.34)	1.28 (0.51)	1.12 (0.17)	0.58	0.5644	0.12
10. Mathematics	.90	1.34 (0.39)	1.81 (0.57)	1.54 (0.57)	1.25 (0.38)	1.22 (0.41)	1.53 (0.42)	1.39	0.1676	0.52
11. Lesson Plans	.85	2.65 (0.68)	2.91 (0.68)	2.90 (0.83)	1.51 (0.89)	1.50 (0.69)	1.43 (0.79)	6.59	<.0001***	1.65
12. Portfolios	1.00	1.17 (0.40)	1.19 (0.51)	1.27 (0.66)	1.60 (1.02)	1.42 (0.59)	1.28 (0.48)	−0.61	0.5420	−0.18
13. Team Teaching	.91	1.61 (0.76)	1.72 (0.80)	1.79 (0.95)	1.55 (0.83)	1.44 (0.75)	1.51 (0.64)	1.18	0.2428	0.36
Total teaching behaviors	.96	1.95 (0.36)	2.14 (0.38)	2.16 (0.37)	1.58 (0.44)	1.66 (0.33)	1.72 (0.35)	4.20	<.0001***	1.04

Note. r^e = interrater agreement correlation coefficients; Print and Letter = print and letter knowledge.
* $p = .05$. ** $p = .01$. *** $p = .001$.

correct valence. Two-person teams of trained coders scored the recorded answers. Each team's main coder coded 100% of the data, and the team's reliability coder scored 25% of the data independently. Agreement for each cohort was good (expressive $\kappa = .94–.99$; receptive $\kappa = .89 – 1.00$; situational $\kappa = .93–.96$).

Child social–emotional functioning. Social competence, adjustment (anger and aggression; anxiety withdrawal), and inhibitory anxiety were assessed by teacher ratings for child social–emotional functioning at three time points. Children's *social competence* was assessed with the 30-item Social Competence and Behavior Evaluation (SCBE–30; LaFreniere & Dumas, 1996). The 30-item version has a 10-item Social Competence Composite subscale. Internal consistencies by time point ranged from .83 to .86. Maladjustment was assessed with two 10-item subscales from the SCBE–30: the Anger Aggression (externalizing) and Anxiety/Withdrawal (internalizing) subscales. This was tested at all three assessment time points; alphas were .89–.90. The Behavioral Inhibition Scale–Anxiety (BIS; Carver & White, 1994) was modified for teacher report (Blair, 2003) and completed by child care teachers in this study to rate child behavioral inhibition due to anxiety at the final two time points. The scale has seven-items (e.g., "This child worries if he or she thinks that he or she has done poorly at something."). Internal consistencies were .70–.71.

Child cognitive performance. Language, literacy skills, and mathematical knowledge were assessed as child cognitive outcomes in this study. The Expressive One-Word Picture Vocabulary Test (EOWPVT; Brownell, 2000) was used to measure children's *expressive vocabulary* skills. The EOWPVT measures children's ability to correctly label an action or concept depicted for individuals 2–18 years old. Examinees are presented with stimulus pages containing an individual color picture and asked to correctly label each drawing. Internal consistency values for 2- to 5-year-olds ranged from .96 to .98 for split-half (corrected) and from .93 to .95 for Cronbach's alpha (Brownell, 2000).

The English and Spanish versions of the Preschool Language Scale (4th ed.; PLS–4; (Zimmerman et al., 2002) were used to assess complex *receptive language* development. Test–retest reliability (mean, 6 days) for the auditory comprehension was .87 and .95. Internal consistency ranged from .91 to .93.

The Print Knowledge subtest from the Preschool Comprehensive Test of Phonological and Print Processing (Pre-CTOPPP; Lonigan, Wagner, Torgesen, & Rashotte, 2002) was used to evaluate *early literacy skills* including letter knowledge and letter sound correspondence in both a multiple-choice and free-response format. In addition, children's knowledge of book and print concepts (e.g., title of a book, discriminating letters or words) was assessed. Internal consistency of the Print Knowledge subtest was adequate (i.e., coefficient $\alpha = .86$) in this sample.

A downward extension of the Child Math Assessment (CMA–DE; Starkey et al., 2004) was used to evaluate the *mathematical knowledge* of children in the project. The CMA–DE is composed of 16 tasks (with multiple problems per task) that assess informal mathematical knowledge in the areas of number, arithmetic, space and geometry, measurement, and patterns. Good reliability for pre-K aged children has been reported (i.e., Cronbach's $\alpha = .84$ at the beginning of the school year; Starkey et al., 2004).

Children's relationship with teacher. The quality of children's relationship with the lead teacher was assessed through child care teacher ratings. The 30-item Adult–Child Relationship Scale (Pianta, Nimetz, & Bennett, 1997) was used to measure child care teachers' perceptions of their relationship with children at the final two time points. Respondents are asked to indicate the presence of certain relationship characteristics in children on a 5-point Likert-type scale ranging from *definitely not* to *definitely* (e.g., "If upset, this child seeks comfort from me"; $\alpha = .89$ for teachers' reports; Ingoldsby, Shaw, & Garcia, 2001). Two subscales were used from this scale including Closeness (e.g., "I share an affectionate, warm relationship with this child") and Conflict (e.g., "This child asks for my help when he or she really does not need help"). Closeness reflects the degree of warmth and open communication between the teacher and child, and conflict refers to negative and coercive teacher–child interactions. Internal consistencies for these subscales were .77–.81 for closeness and .87–.88 for conflict.

Data Analyses

General analytic strategy. Because most measures were collected at multiple time points (fall, winter, spring), a growth modeling strategy was used. In the growth models with two or three time points, growth was modeled as a function of time, centered at the final spring assessment. For measures only assessed at Wave 3, analysis of covariance was conducted. Mixed model analyses were used because such analyses control for nesting of the data (e.g., time nested within teacher), permit the inclusion of data for all participants with at least one assessment (*N*s for each teacher and child measure and time point are provided in online Appendix E), and allow examination of predictors for individual patterns of growth rather than group means (Bryk & Raudenbush, 1992). All analyses were conducted using SAS Proc Mixed software (SAS Institute, 2010).

Each growth curve model provides parameter estimates (a) for development at a specific point in time or level (intercept), (b) for rate of growth (slope), and (c) for change in rate of growth (curvature, or nonlinear growth). The intercept and slope were random effects, whereas the curvature term was fixed. In the case of only two waves of data, only the intercept was modeled as a random effect. The intercepts for the models were centered at the last time point so that the estimates reflected the level and change in behavior at the posttest. For each model, a priori contrasts were used to compare the average of the intervention groups to the controls and the intervention groups to each other. Such contrasts are preferred over pairwise comparisons as they are orthogonal and do not involve redundant questions.

Due to potential treatment effects at pretest, effect sizes were computed as the mean pre–post change of the treatment group minus the mean pre–post change of the control group, divided by the standard deviation of controls at baseline (Hess & Olejnik, 2001). The standard deviation of raw scores, rather than model-estimated change scores from the multilevel model, was used so that (a) effect sizes were reported in the same metric across studies and (b) effect sizes were not inflated due to use of only the within-subject variance (Feingold, 2009; Morris, 2008).

Research Question 1: Teacher-level analyses. Our first objective was to assess the effect of the intervention on teacher skills as indicated by the TBRS. The TBRS was assessed at three time points, so growth curve analyses were conducted. Analyses were conducted with the following variables included as covariates:

teacher education, years of teaching experience with young children, years of teaching experience at the current school, and having a Child Development Associate credential. There were no significant teacher covariates, and thus they were not retained in final models.

Research Question 2: Child-level analyses. Our next question assessed the effect of the intervention on child outcomes, and analyses were also conducted with a mixed model approach. However, because children were also nested within classrooms, classroom-level random intercepts and slopes were also modeled. For the analyses of child outcomes, two covariates were examined: child's initial age and teacher's possession of a CDA. Only child's initial age was significant and was retained in all models. Classroom- and child-level intraclass correlation coefficients are presented in Appendix F of the online supplemental materials.

Research Question 3: Mediation analyses. For Objective 3, we examined whether the effect of the intervention on child outcomes was mediated by the effect of the intervention on teacher behavior as measured by the TBRS. Mediation was tested using a bootstrapping process (Preacher & Hayes, 2008), where samples equal in size to the total sample, but taken with replacement, are selected from the total sample, and two models are tested for each outcome and mediator. One model is the original model for the mediator (TBRS scores used to evaluate Objective 1), and one model is for the original model for the outcome (child outcomes used to evaluate Objective 2) but with the mediator added as a time-varying covariate. The effect of the grouping variable on the mediator is *a* and the effect of the mediator on the outcome (with group in the model) is *b*. The indirect effect is given by the product a^*b.

Because product terms such as this are not distributed normally, conventional significance tests that assume a normal distribution are biased. With bootstrapping, we avoid this issue by establishing an empirical distribution for the indirect effect, which can then be used to test for significance (Preacher & Hayes, 2008). With three groups, there are two parameters for *a*. As most of the effects on the TBRS mediators were consistent across the RECC and RECC+ groups, a parameter representing the difference between each intervention group and control was used. We performed 1,000 bootstrap replications of each model and derived the 95% confidence intervals for the indirect effects from the distribution of effects across the samples.

Results

Research Question 1: Effect of the Intervention Programs on Teaching Behaviors

Growth curves were used to assess the effect of the intervention programs on the TBRS. Because pretesting was conducted over the first 2 months of the school year, most of the teacher and child variables were being collected after the start of the intervention, preventing the consideration of the fall assessment as a pure baseline measure. However, we did have TBRS observations for the original 65 teachers in the priming phase (spring before intervention began; see descriptives in online Appendix G). To confirm our random assignment procedures, we looked for differences between the groups on all of the TBRS subscales at priming and found none, Fs(2, 63) < 2.44, *ns*. In addition, we also compared the groups with only those teachers who were used in the final analyses, and again, there were no differences between groups, Fs (2, 38) < 2.68, *ns*.[1] Therefore, observed differences between groups at pretest were not due to unsuccessful randomization, either in the full priming sample or the sample used in the final analyses after attrition.

Significant group differences at posttest were found for the average of all TBRS subscales in favor of both intervention groups, as shown in Table 2. The intercept results were significant in many of the subscale analyses with moderate to large effect sizes. No slope results were significant, although they were in the correct direction. TBRS descriptives by each intervention condition are in online Appendix D. For all significant findings, both the RECC and RECC+ intervention groups had higher scores than the control group and did not differ from each other. By the posttest, eight of 13 TBRS subscales and the total score within the RECC and RECC+ classrooms were between the medium low and medium high descriptive categories. In contrast, in the control condition, only three of 13 subscale scores reached the medium low quality rating. Classrooms scoring between the medium low and medium high categories are providing a fair amount of stimulation to students.

Research Question 2: Effect of the Intervention Programs on Child Outcomes

Significant group differences were found for a number of child outcomes described below by each skill domain. Means and standard deviations are shown in Table 3.

Child emotional understanding. Level and rate of growth in emotional understanding were evaluated across all three time points. Level of expressive and receptive emotional understanding scores varied by age, with older children demonstrating higher scores, but this was consistent across groups. There was no difference between intervention groups on these tasks, but the average of the two intervention groups was higher than controls for *expressive* emotion understanding, $t(58) = 3.39$, $p = .0012$; effect size = 0.47, and *receptive* emotion understanding, $t(57) = 2.61$; $p = .0114$; effect size = 0.25. There were no slope differences between groups. At Times 2 and 3, children were given the *situational* emotions task. Again, results show a significant difference between the average of the two intervention groups versus the controls, $t(53) = 2.87$, $p = .0058$; effect size = 0.44, and no significant difference between intervention groups.

Child academic performance. No significant group differences were found for growth in children's vocabulary (EOWPVT), early literacy (Pre-CTOPP), complex language (PLS-4), or math knowledge (CMA–DE; see descriptive statistics Table 3).

Teacher–child relationship quality. Child age was not significantly related to closeness. The average closeness of RECC+ and RECC groups (see Table 3 descriptives) was greater than for controls, $t(52.4) = 2.84$, $p = .0065$; effect size = 0.42. The average teacher-child conflict of both the RECC+ and RECC

[1] For the sake of completeness, we performed all TBRS analyses both with and without the baseline TBRS score as a covariate with the reduced sample. Results were consistent, so estimates are reported from the analyses on the full sample without the priming covariate.

Table 3
Average Child Outcomes by Time Point and Condition

Outcome/group	Time 1 *M* (*SD*)	Time 2 *M* (*SD*)	Time 3 *M* (*SD*)
Expressive Emotional Understanding, $N = 504$			
RECC	0.36 (0.48)	0.67 (0.65)	0.91 (0.73)
RECC+	0.49 (0.59)	0.79 (0.71)	0.95 (0.73)
Control	0.32 (0.50)	0.47 (0.59)	0.75 (0.70)
Receptive Emotional Understanding, $N = 505$			
RECC	0.57 (0.26)	0.76 (0.24)	0.84 (0.21)
RECC+	0.61 (0.24)	0.84 (0.19)	0.88 (0.19)
Control	0.60 (0.22)	0.73 (0.23)	0.80 (0.24)
Situational Emotional Understanding, $N = 341$			
RECC	—	0.41 (0.52)	0.64 (0.59)
RECC+	—	0.49 (0.51)	0.67 (0.56)
Control	—	0.32 (0.46)	0.54 (0.56)
Teacher–Child Closeness, $N = 388$			
RECC	—	4.24 (0.58)	4.32 (.57)
RECC+	—	4.28 (0.61)	4.20 (.62)
Control	—	3.82 (0.68)	4.09 (.73)
Teacher-Child Conflict, $N = 388$			
RECC	—	2.02 (0.87)	1.94 (.80)
RECC+	—	2.20 (1.03)	2.13 (.95)
Control	—	2.33 (0.89)	2.42 (.96)
Early Literacy, $N = 490$			
RECC	33.28 (7.52)	37.62 (6.97)	39.29 (7.61)
RECC+	35.05 (7.18)	39.01 (8.23)	41.06 (7.88)
Control	34.69 (7.74)	39.04 (8.32)	40.56 (7.94)
Early Mathematical Knowledge, $N = 490$			
RECC	16.23 (12.92)	23.73 (16.81)	28.08 (19.32)
RECC+	18.48 (14.44)	27.55 (17.86)	34.99 (20.70)
Control	19.09 (15.07)	24.97 (16.66)	31.56 (18.58)
Social Competence, $N = 392$			
RECC	3.40 (0.77)	3.41 (0.73)	3.76(0.85)
RECC+	3.47 (0.85)	3.86 (0.91)	3.78 (0.80)
Control	3.59 (0.85)	3.46 (0.88)	3.54 (0.96)
Anger/Aggression, $N = 392$			
RECC	2.72 (0.97)	2.28 (0.73)	2.32(0.81)
RECC+	2.47 (0.95)	2.52 (1.14)	2.45 (0.88)
Control	2.54 (0.96)	2.44 (0.93)	2.45 (1.02)
Anxiety/Withdrawal, $N = 392$			
RECC	2.42 (0.70)	2.11 (0.57)	2.05 (0.59)
RECC+	2.38 (0.65)	2.34 (0.91)	2.30 (0.79)
Control	2.55 (0.82)	2.45 (0.71)	2.36 (0.77)
Anxiety (Behavioral Inhibition Scale), $N = 373$			
RECC	—	3.89 (1.11)	3.87 (0.93)
RECC+	—	4.60 (0.87)	3.86(0.99)
Control	—	3.97 (0.71)	4.13 (0.98)
Vocabulary, $N = 493$			
RECC	15.60 (9.69)	—	22.97 (10.67)
RECC+	17.69 (11.36)	—	24.71 (11.95)
Control	17.55 (10.01)	—	23.80 (10.59)
Complex Language, $N = 492$			
RECC	3.06 (4.40)	5.29 (6.51)	6.67 (7.79)
RECC+	3.03 (3.74)	5.95 (6.78)	7.40 (8.41)
Control	4.04 (5.75)	6.603 (8.18)	8.73 (9.25)

Note. Dashes indicate measure was not given at time point. *N*s represent maximum number of observations. RECC = Responsive Early Childhood Curriculum; RECC+ = Responsive Early Childhood Curriculum plus explicit social–emotional classroom activities.

group was lower than for controls, $t(51.6) = -2.63$, $p = .0114$; effect size = −0.49.

Child social–emotional functioning. For anxiety on the BIS, there was a significant difference in the slopes between the control and intervention groups, $t(157) = 3.36$, $p = .001$, and between the RECC and RECC+ groups, $t(157) = 3.36$, $p = .001$. Whereas there was a small and nonsignificant rise in anxiety in the RECC group between Time 2 and Time 3, $t(160) = -1.40$, $p = .165$, anxiety among controls increased significantly, $t(157) = -4.35$, $p < .0001$, and the RECC+ group showed a significant decline in anxiety compared with the RECC group.

Change in social competence, anger and aggression, and anxiety-withdrawal was evaluated from the SCBE across all three time points. Because we observed differences in curvature within

the growth model, we employed a repeated-measures design for these analyses to simplify the interpretation of these results. Age was related to children's social competence levels, with older children demonstrating higher scores, $F(1, 930) = 30.12$, $p < .0001$. The intervention groups showed more change over time in social competence with higher scores at Time 3 than the control group who showed no change over time, $F(4, 957) = 3.35$, $p = .0098$. For the RECC group, the difference between Time 1 and Time 3 scores was significantly greater than controls, $t(967) = 2.32$, $p = .0204$; effect size = 0.42. For the RECC+ group, the difference in social competence scores was significantly greater than that of controls from Time 1 to Time 2, $t(974) = 2.16$, $p = .031$; effect size = 0.39, and from Time 1 to Time 3 but not significantly so, $t(964) = 1.20$, $p = .2296$; effect size = 0.21.

Groups differed in their changes over time on Anger/Aggression subscale from the SCBE, $F(4, 966) = 3.23$, $p = .0121$. Children in the RECC condition demonstrated greater decreases in their scores compared with both the RECC+ (Time 2 − Time 1), $t(977) = -2.61$, $p = .0091$; effect size = −0.43 (Time 3 – Time 1), $t(972) = -2.14$, $p = .0324$; effect size = −0.36, and control groups (Time 2 − Time 1), $t(986) = -2.60$, $p = .0095$; effect size = −0.48 (Time 3 − Time 1), $t(977) = -3.08$, $p = .0021$; effect size = −0.55. There were no differences on the Anxiety/Withdrawal subscale.

Research Question 3: Mediating Effect of Child Care Teacher Behaviors on Child Outcomes

Mediation results are discussed by child outcome. Table 4 specifies the outcome, proposed mediator, and percentiles to allow the statistical inference. As we hypothesized the direction of findings based on theoretical considerations, we report one- and two-tailed tests of significance. We used only the total score on the TBRS as a mediator for those child outcomes where there were significant differences by group. However, if the TBRS total score did not mediate a particular result, we did look at the appropriate subscale of the TBRS to see if specific teacher behaviors may have mediated the effect of the intervention on outcomes.

Child emotional understanding. There was evidence of partial mediation for both intervention groups compared with the control group on children's ability to identify and point to faces based on scenarios (understanding situational emotions) by the total TBRS score.

Child social–emotional functioning. The effect of the intervention on teacher ratings of children's ability to inhibit behavior due to anxiety was mediated by TBRS scores for learning centers and lesson plans for both intervention groups compared with the control group. As higher values on anxiety meant worse outcomes,

Table 4
Teacher Behaviors Mediating Child Outcomes With Significant Intervention Effects

Child outcomes	TBRS mediator[a]/group	Confidence intervals			
		$p < .025$	$p < .05$	$p > .95$	$p > .975$
Social–emotional understanding					
Receptive emotion understanding	Print/Letter				
	RECC+	−.00031	.00135	.03399	.03774
Situational emotion understanding	Total TBRS				
	RECC+	−.01544	.00347	.17738	.19637
	RECC	−.00901	.00172	.12017	.13538
Social–emotional functioning					
Anxiety	Learning Centers				
	RECC+	−.40637	−.38373	−.07156	−.03718
	RECC	−.43781	−.40636	−.07206	−.04177
	Lesson Plans				
	RECC+	−.47631	−.44931	−.11053	−.08940
	RECC	−.35283	−.32449	−.08194	−.06556
Social competence	Print/letter				
	RECC+	.01214	.02081	.20895	.23458
	Written expression				
	RECC+	−.00749	.00029	.11957	.14164
Relationship With Teacher					
Teacher–Child Closeness	Book reading				
	RECC	.00779	.01646	.14884	.16568
	Lesson plans				
	RECC+	.00316	.01107	.14632	.16567
	RECC	.00087	.00759	.11722	.13181
	Print/letter				
	RECC+	−.00686	.00182	.14590	.15758
Teacher–Child Conflict	Book reading				
	RECC	−.22929	−.20083	−.00941	.00484

Note. The two outer columns under $p < .025$ and $p < .975$ represent lower and upper 95% confidence intervals. The two inner $p < .05$ and $p < .95$ columns represent one-tailed confidence intervals. RECC = Responsive Early Childhood Curriculum; RECC+ = Responsive Early Childhood Curriculum plus explicit social–emotional classroom activities.

[a] Teacher Behavior Rating Scale (TBRS) subscales labeled as Print/Letter = print and letter knowledge, and Teacher–Child = Teacher–Child Relationships subscale.

the mediation effect was negative, meaning that teacher behaviors were inversely related to anxiety.

Teacher–child relationship quality. The effect of the intervention on teacher ratings of closeness showed evidence of mediation by the Lesson Plans subscale for both intervention groups compared with the control group. There was also evidence of mediation by TBRS scores for book reading in the RECC group and print and letter knowledge in the RECC+ group. In addition, the results supported that teacher ratings of conflict with children mediated the effect of the RECC group compared with the control group on book reading.

Discussion

In support of the study hypotheses, teachers who received the RECC and RECC+ interventions, compared with control teachers, showed higher scores at posttest with moderate to large effect sizes in their overall interactions with 2- and 3- year old children, including rich language input, classroom organization and planning, and implementation of engaging learning activities. These findings are noteworthy given that at baseline the teachers and classroom environments across the three conditions did not differ on the TBRS subscales, with all classrooms showing little evidence of a daily schedule, lesson plans, predictable routines, or implementation of learning activities. This study makes an important contribution to the limited randomized control studies in classrooms serving low-income 2- and 3-year-olds by demonstrating that staff with limited education and training can be facilitated to improve their responsive behaviors with groups of young children that, in turn, promote greater increases in children's development.

Increases in Teachers' Responsive Practices and Early Academic Readiness Activities

Teacher behaviors improved particularly for topics that received specific focus in the initial coaching sessions: (a) establishing a schedule and teaching children how to anticipate what would happen across the day, and (b) setting up the classroom so that children could access various materials (e.g., puzzles, blocks) and books placed in small cozy spaces within the room to give children choices. Improvement in these areas was evidenced by higher levels for RECC and RECC+ teachers compared with controls on the Implementation of Learning Centers (effect size = 1.58), Lesson Plans (effect size = 1.82), and the General Classroom Community (effect size = 0.77) subscales of the TBRS. Environments that provide young children with a sense of organization and structure in combination with opportunities to make choices and engage in responsive interactions support the development of social behaviors (cooperation and self-regulation; Grusec & Davidov, 2010) and prevent children from becoming anxious because of a lack of predictable routines (Gunnar et al., 2010). These are issues of paramount importance for this age, given that studies examining the neurochemical stress response in high- versus low-quality centers show the negative effects of poor-quality child care including problematic behavioral as well as negative physiological outcomes (Geoffroy, Coté, Parent, & Seguin, 2006).

Intervention, compared with control, teachers also showed significantly higher levels in their incorporation of cognitively rich activities including book reading (effect size = 0.92), opportunities for building language (effect size = 0.74), early writing experiences (e.g., drawing, scribbling, making letter approximations; effect size = 0.80), and discussion of how print and books work (effect size = 0.93). Two areas of instruction where intervention effects were not seen were phonological awareness and mathematics. It may be that these skill areas were perceived as more academic than book reading or language activities, and thus, the teachers were not as comfortable with implementing them with toddler-age children. Alternatively, there were so many new practices to learn that teachers may not have been able to incorporate all of them; indeed, math fidelity was particularly low. Future attempts to improve the quality of these types of center-based settings might consider a staging-in approach where teachers are supported in implementing new practices (e.g., responsive behaviors, cognitive activities), one practice at a time until acceptable implementation occurred.

Relative to other professional development and coaching interventions, the demands of the intervention on teachers was relatively high, with weekly coaching sessions across 37 weeks along with four group training workshops, totaling approximately 92 hr. For example, some recent coaching interventions with pre-K and toddler teachers involved a shorter duration of 14 weeks for about 23.5 hr (Girolametto et al., 2003). On the other hand, the Bierman et al. (2008) study in which teachers were trained to use a comprehensive school readiness curriculum provided even more hours than our intervention, totaling over 150 hr of coaching and group trainings. The high turnover rate in child care centers accepting subsidies (30%–37%; Helburn & Howes, 1996; Whitebook & Sakai, 2003) make these issues of duration and training dosage important future areas for systematic study, with experiments contrasting the impact and feasibility of changing teacher behavior at different levels of intervention intensity.

Intervention Impacts on Children's Skills

The RECC and RECC+ interventions had several important impacts on children's skills related to social competence and behavior regulation (effect size range = 0.21–0.41), and emotion understanding (effect size range = 0.25–0.48) compared with children in the control condition. Thus, increases in behaviors such as cooperation, regulation of emotion (calmness), and appreciation of others' needs were influenced positively by both responsive interventions. It is noteworthy that the interventions showed an impact on positive changes in social and emotional development with direct measures of child skills as well as teachers' ratings of children's behaviors.

Although we expected children to show the largest gains in social and emotional skills if they were in RECC+ classrooms, in only two instances did the intervention groups differ from each other in child outcomes. First, children in the RECC+ group demonstrated greater decreases in anxiety than children in the control condition (effect size = −0.55). The control children showed an increase, and the children in the RECC group showed no change. The extra time the RECC+ child care teacher spent each day talking and reading about emotions may have allowed the children to feel more comfortable and relaxed in the classroom setting. Alternatively, the teacher may have become more aware of

the children's emotional state through the additional social–emotional activities implemented in the RECC+ condition.

The second difference included lower anger and aggression scores in the RECC group compared with the RECC+ (effect size = −0.36) and control groups (effect size = −0.55). While increased responsive practices for the RECC group was expected, it is not clear why the RECC+ group did not show a similar or greater decrease. Possibly, in light of the RECC+ teachers incorporating the explicit social–emotional activities, they became more sensitized to the children's aggressive behavior. Or a more troubling possibility is that the children's aggression levels did not improve due to something in the RECC+ condition; for example, the requirement of a daily explicit social–emotional activity may have not left sufficient time for independent, child-choice activities.

The high salience of this age period for the development of social–emotional skills (Ayoub, Vallotton, & Mastergeorge, 2011), in combination with the high demands for regulation of behavior in the child care center compared with in the home setting, may help explain the effect of the interventions on these developmental areas. Also, these skills have been reported to provide the most benefit in higher quality programs and enhancing them may better prepare young children for pre-K and kindergarten (Watamura, Phillips, Morrissey, McCartney, & Bub, 2011). Greater gains for children in both interventions compared with control children on teachers' ratings of the closeness of the teacher–child relationship (effect size = 0.42) and decreases in conflict (effect size= −0.49) are also noteworthy, as these behaviors predict children's ability to take advantage of learning opportunities later in school (Howes & Smith, 1995) and to sustain close relations with teachers across preschool to kindergarten (Howes, Phillipsen, & Peiser-Feinberg, 2000). Theoretical underpinnings for the closeness of the teacher–child relationship come from the attachment theory, as the child uses the positive relationship with an adult who is significant in his or her life as a secure base, and this supports the child's ability to organize and explore their environment (Howes et al., 2000; Pianta et al., 1997). A possible limitation of the teacher–child relationship measure is that it is based on teacher report rather than independent observations. However, studies have shown good agreement between independent observations and teacher-report measures of relationship quality (e.g., Howes & Ritchie, 1999).

These findings are aligned with recent studies evaluating other curricula or professional development approaches targeting social and emotional skills with teachers of 4-year-olds that have resulted in improved self-regulation (Barnett et al., 2008), emotion knowledge (Domitrovich, Cortes, & Greenberg, 2007; Izard et al., 2008), social competence (Domitrovich et al., 2007), and decreases in negative behaviors (Domitrovich et al., 2007; Izard et al., 2008). As these previous studies targeted more educated teachers in classrooms with older children, it is difficult to directly compare the findings of the current study, as it is unique in attempting to change teacher practices with non-degreed staff in child care settings serving toddlers from low-income backgrounds.

Contrary to expectations, the intervention did not show effects for children's language, early literacy, or mathematics skills. However, child care teachers demonstrated only low to moderate fidelity of implementing most early academic readiness activities in the curriculum. These levels of implementation may not have been of sufficient intensity to impact children's cognitive outcomes. An alternative explanation is that the large number of teacher-led cognitive readiness activities was too intensive. Another recent large randomized trial in pre-K settings that also layered together several curricular components with an enhanced milieu teaching style (Kaiser et al., 2011) reported few differences in language and literacy outcomes. The lack of systematic differences for cognitive skills in our study and Kaiser et al. lead to questions about how to ensure appropriate levels of fidelity and intervention intensity, considering both what is required to train teachers and what number of learning episodes are optimal for children.

Child Care Teacher Behaviors as Mechanisms for Improving Child Outcomes

As hypothesized, levels of teachers' responsive practices explained, in part, the effect of the intervention on significant gains in the children's skills, adding to a body of evidence that more positive social interactions between the childcare teacher and young children supports better child outcomes (Loeb, Fuller, Kagan, & Carrol, 2004). For example, practices observed for the intervention teachers, such as orienting children to expectations through established routines and involving them in carrying out the "work" of the classroom (knowing where things go, having jobs), as well as engagement with cognitive activities in centers and in small and large groups appear to be key for understanding the effect of the intervention on children's increases in emotional and social skills as well as their decreases in anxiety.

Of interest, decreased teacher–child conflict and increased closeness with teacher were mediated by the quantity and quality of teachers' shared book-reading practices. Higher scores on this area of the TBRS reflected more encouragement of children's engagement in talking about books and book-related activities (e.g., acting out the story) as well as sensitivity to young children's need for animated facial expressions and voicing and pacing to support immature attention skills. A responsive affective-emotional climate during book reading is linked with children showing greater enthusiasm for the reading experience and cooperation (Bus, Belsky, van IJzendoorn, & Crnic, 1997; Leseman & de Jong, 1998). The importance of positive shared book-reading experiences, in the present report, for understanding increases in the closeness of the teacher–child relationship and decreased conflict provides some of the first causal support for the influence of classroom-based book reading on social–emotional outcomes for toddler children.

Limitations and Future Directions

There is a dearth of experimental studies that have attempted to improve the quality of child care settings serving low-income 2- and 3-year-olds. In light of this, a number of questions need to be addressed that were not addressed in this or other existing studies. These include determining whether a longer or more gradual intervention (e.g., add the language and literacy curriculum in Year 1, add math and social–emotional curriculum in Year 2) would have supported teachers in showing the quality and fidelity of implementation that would have resulted in gains not only in social–emotional skills but also cognitive skills. Likewise, future studies could examine whether children further benefit from a

combination of interventions to ensure a responsive caregiving style both at school and in the home or across multiple years of preschool.

In addition to these unanswered questions, there were limitations to this experimental study. First, a limitation was the high levels of teacher and child attrition. Implementing an intervention in low-income child care settings has many challenges. Low wages and instability in the lives of the staff and in the centers' management resulted in 43% of classrooms having changes in teaching staff across the intervention period. Given that randomization was at the center/classroom level, we chose to train replacement teachers rather than dropping the classroom if a teacher left the study; this could be considered a limitation. In part, because parents were required to remove their child from the center if they lost their job and had to get recertified to receive subsidies, this study had a higher child attrition rate (26% attrition) than is sometimes reported for interventions in Head Start programs (Domitrovich et al., 2007; 15% attrition), although it is relatively comparable to others (Izard et al., 2008; 24% attrition). Another limitation involves the timing of assessments. We needed to allow children time to acclimate to their new classrooms and to obtain informed parental consent, which meant we had to start the first wave of child assessments approximately 3–8 weeks after the start of the intervention. Similarly, we had to start the final wave of child assessments 4–8 weeks before the end of the school year. Thus, we did not have true pre- and posttests. Likewise, for many teachers, we did not have a true baseline TBRS observation because the priming phase of the intervention began in the spring before the focal academic year, and there was considerable teacher turnover during the summer or after the start of the intervention. Despite these limitations, this study shows the promise of a comprehensive training and curriculum model in centers serving low-income families and for enhancing the social and emotional skills young children need to enter preschool and kindergarten ready to succeed.

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