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Effects of Parent and Child Pre-Intervention Characteristics on Child Skill Acquisition during a School Readiness Intervention

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Abstract

200 preschool children in Head Start (55% girls; 20% Hispanic, 25% African-American, 55% European American; *M* age = 4.80 years old) participated in a randomized-controlled trial of a home visiting intervention designed to promote their emergent literacy skills (the Research-based Developmentally Informed parent [REDI-P] program). This study explored concurrent changes in levels of parent support and child literacy skills that occurred over the course of the intervention, and examined the impact of pre-intervention parent support and child literacy skills as potential moderators of parent and child outcomes. Cross-lagged structural equation models and follow-up analyses indicated that intervention had the strongest impact on child literacy skills when parents were high on support at the pre-intervention assessment. Conversely, the REDI-Parent program promoted the greatest gains in parent support when parents entered the program with low levels. These findings suggest that families may benefit from home visit school readiness interventions in different ways: child skill acquisition may be greatest when parents are initially high in support, whereas parenting may improve most when parents are initially low in support.

Keywords

School Readiness; Intervention; Parent; Parental Support; Literacy

Developmental research suggests that much of the socio-economic gap in child school readiness is due to differences in the amount and quality of support for learning provided by parents during early childhood (Hart & Risley, 1995). Parent-focused interventions have been designed to close this gap, using a range of strategies during the preschool years to enhance child school readiness at kindergarten entry (see reviews by Brooks-Gunn & Markman, 2005; Welsh, Bierman & Mathis, 2014). Some programs focus primarily on improving the general quality of parent-child interactions and thereby increasing parent support for learning, whereas other programs engage parents more specifically as tutors by providing them with home learning materials and coaching them in specific, evidence-based teaching strategies (Gomby, 2005; Mol, Bus, de Jong, & Smeets, 2008; Reese, Sparks, & Leyva, 2010). The growing research base suggests that using parents as tutors for young children may be a more reliable strategy for improving child language and literacy skills than focusing more generally on increasing parent support (Welsh et al., 2014). At the same

time, the impact of programs that use parents as tutors are attenuated for children living in poverty (Mol et al., 2008), perhaps because the supports and skills that parents need to engage effectively in specific, evidence-based teaching activities are reduced under conditions of socio-economic disadvantage (Manz, Hughes, Barnabas, Bracaliello, & Ginsburg-Block, 2010).

Given the importance of promoting the school readiness skills of children growing up in poverty, further research is needed in order to better understand the potential role of parent support as a moderator of the impact of parent tutoring interventions (Brooks-Gunn & Markman, 2005). In addition, given the inter-dependence between parent support and child skills, understanding the impact of baseline child skills on parent teaching attempts and program impact is important as well (Anthony et al., 2014). This study examined initial (pre-intervention) levels of parent support and child literacy skills as potential moderators of the impact of the REDI (Research-based Developmentally Informed) parent [REDI-P] program, an enriched home visiting program that included a home learning curriculum and evidence-based teaching strategies aligned with the REDI classroom program (Bierman et al., 2008). As background for this study, the following sections provide a brief review of preschool home visiting programs designed to promote school readiness, an overview of the REDI-P program, and existing evidence of moderation in prior preschool home visiting studies.

Parenting Programs Designed to Promote Child School Readiness

Several widely-used home visiting programs for economically-disadvantaged preschool children focus on promoting parent support for learning in order to boost child academic school readiness. For example, the Parent-Child Home Program (Levenstein, Levenstein, & Oliver, 2002), Parents as Teachers Program (PAT; Pfannenstiel, Lambson, & Yarnell, 1991), and Home Instruction Program for Preschool Youngsters (HIPPY; Lombard, 1981) are three long-standing and widely-used home visiting programs. In each case, the general approach is to increase parent support for learning by helping parents more effectively talk and play with their children. In these home visit programs, program staff provide information about child development, model appropriate activities, encourage self-reflection, provide performance feedback, and in some programs, facilitate access to social and support services (Lombard, 1981; Pfannenstiel et al., 1991; Levenstein et al., 2002).

Although quasi-experimental studies show promising results for each of these widely-used programs, randomized-controlled trials document a lack of reliable impact on child academic skills. For example, randomized-controlled studies failed to find positive effects for the Parent-Child Home Program on child school readiness outcomes (Madden, O'Hara, & Levenstein, 1984; Scarr & McCartney, 1988), or for PAT on child cognitive development, language development or adaptive behavior (Drotar, Robinson, Jeavons, & Kirchner, 2009; Wagner, Spiker, & Linn, 2002). One cohort of children participating in HIPPY had improved reading skills at the end of first grade, but no effects emerged for the second cohort (Baker, Piotrkowski, & Brooks-Gunn, 1998).

An alternative approach to promoting academic school readiness involves engaging parents more specifically as tutors for their young children and coaching them in specific, evidence-

based teaching strategies. For example, parent-focused interactive reading programs teach parents how to use questions while reading books to engage child interest, clarify new vocabulary, and facilitate comprehension (Whitehurst et al., 1994). Meta-analyses demonstrate positive effects on child language and emergent literacy skills when parents are trained to read interactively with their young children (Manz et al., 2010; Mol et al., 2008). Similarly, parents can be taught to use letter and letter-sound recognition games at home to promote child letter knowledge and phonemic awareness skills (Evans, Bell, Shaw, Moretti, & Page, 2006; Senechal, 2006), and to refer to print during book-reading to support the development of print concepts (Justice, Skibbe, McGinty, Piasta, & Petrill, 2011; see also the review by Reese et al., 2010). Despite the generally positive effects of these programs that help parents use evidence-based approaches to teach their young children, researchers have raised concerns that they may over-burden and insufficiently support economically-disadvantaged parents who are often challenged by multiple stressors, including low levels of formal education, limited resources, and low levels of social support (Manz et al., 2010). For example, as a function of limited education and elevated stress exposure, economically-disadvantaged parents may not provide sufficient positive and sensitive support when teaching their children, resulting in child resistance and fewer academic gains (Manz et al., 2010).

The REDI-Parent Program

The REDI-P home visiting intervention was designed to provide parents of Head Start children with a home learning curriculum and coaching in evidence-based teaching strategies, tailored for low-income parents to reduce burden and provide support for parent implementation. The REDI-P program built upon and extended the evidence-based REDI classroom enrichment program, which targeted child school readiness in the dual domains of social-emotional development and language-emergent literacy skills. In the REDI classroom program, teachers delivered the Preschool PATHS (Promoting Alternative Thinking Strategies) curriculum to support the acquisition of prosocial skills, emotional understanding, self-regulation, and social problem-solving skills (Dimitrovich, Cortes, & Greenberg, 2007), and also implemented a dialogic reading program to promote oral language skills, a Sound Games program to build phonological sensitivity, and Alphabet Center activities to strengthen print knowledge (Bierman et al., 2008). A randomized-controlled trial documented positive effects for the REDI classroom program on preschool outcomes in both social-emotional and language-literacy domains (Bierman et al., 2008). Most of the social-emotional outcomes were sustained one year later after children transitioned into kindergarten, but only one literacy measure (phonological decoding) showed a sustained intervention effect (Bierman et al., 2014).

The REDI-P program was designed to expand the impact of the classroom program across the transition into kindergarten, with a particular emphasis on promoting sustained benefits in literacy skills. In order to increase parent support for learning as children transitioned into kindergarten, REDI-P included 10 bi-weekly home visits in the spring of the Head Start year prior to transition and 6 “booster” visits post-transition in the fall of the kindergarten year. Similar to the programs utilizing parents as tutors described above, parents were provided with books, letter identification and letter-sound learning activities, and learning games. In

addition, home visitors coached parents in the use of positive support strategies for parent-child interactions, using demonstration DVDs, discussions, reflection and goal-setting activities, and videotaped feedback (Bierman et al., 2014).

Parent support was targeted for special emphasis in REDI-P based on research suggesting that a supportive approach may increase parent's capacity to engage their children effectively in learning activities, and parents who are supportive when they work with their children may have a greater impact on the growth in child skills (Landry, Smith, & Swank, 2006; Nye, Turner, & Schwartz, 2006). Interactions high in parent support are characterized by positive affect (e.g. smiling, laughing), expressed affection (e.g., praise, tenderness, physical affection), a child-centered focus, and sensitive responding to child cues (Dennis, 2006; Landry et al., 2006). High levels of parent support are linked with the development of self-regulation skills (Dennis, 2006) and associated with elevated academic achievement in both reading and math in elementary school (NICHD Early Child Care Research Network, 2002).

Outcome analyses from a randomized-controlled trial demonstrated that, relative to a control group involving "mail home" math games, REDI-P significantly enhanced child emergent literacy skills in kindergarten, and led to more favorable kindergarten teacher ratings in areas of academic performance, self-directed learning, and social competence (Bierman, Welsh, Heinrichs, Nix & Mathis, 2014). Although parents in the intervention condition reported talking more often with their children and reading more interactively than parents in the control condition, observations of parent-child interactions revealed no significant main effects of REDI-P on parent support (Bierman et al., in press). An important unanswered question is whether levels of parent support at baseline moderated the impact of the REDI-P program on child or parent outcomes.

Evidence of Moderation in Parenting Programs Targeting Child School Readiness

In general, the degree to which parent characteristics may moderate the impact of parenting programs targeting child school readiness is understudied and of high importance (Manz et al., 2010). The fact that quasi-experimental studies of many parenting programs show significantly stronger effects than randomized controlled studies (Sweet & Applebaum, 2004) suggests that home visiting programs may be more effective for some families than for others. For example, factors such as parenting skills and motivation may serve as selection biases in quasi-experimental trials and predict more positive program outcomes for children than found in randomized-controlled trials. A few randomized trials of parenting programs to promote school readiness have tested for moderation associated with socio-economic risk, providing emerging evidence that children benefit most when parents have fewer risks. For example, working with a low-SES sample (e.g., parents of children attending Head Start), Sheridan, Knoche, Kupzyk, Edwards, and Marvin (2011) found that gains in child language and literacy outcomes were attenuated when parents had less than a high school education or significant health concerns. Similarly, in a meta-analysis of parent-focused interactive reading programs, effects for children from "at risk" families (e.g., low

income, less educated mothers, recipients of governmental support) were smaller than for children in more advantaged families ($d = .13$ vs. $d = .53$; Mol et al., 2008).

Interestingly, findings are mixed in terms of the conditions favoring parent skill growth. One meta-analysis suggested that effects on parenting skills measured by home observations were highest for lower risk (non-adolescent, middle-class) parents (Bakermans-Kranenburg, van IJzendoorn, & Bradley, 2005), whereas another analysis of six studies suggested that the parents who gained the most in terms of positive behavior management skills were those with the lowest pre-intervention skill levels (Beauchaine, Webster-Stratton, & Reid, 2005). Similarly, two studies of preschool children suggest that children may benefit more from school readiness interventions when they start programs with low levels of the skills being taught (Anthony et al., 2014) or have risk factors associated with low school readiness (e.g., developmental concerns, disabilities, and non-English speakers; Sheridan et al., 2011).

The Present Study

The present study sought to expand understanding of the ways that pre-intervention levels of parent and child skill levels may moderate outcomes of home visiting programs targeting school readiness. Initial levels of parent support and child literacy skills were studied as possible moderators of parent and child outcomes in the REDI-P intervention, which used a home literacy learning curriculum and coached parents in evidence-based teaching strategies. Prior analyses of the REDI-P program showed that, within the intervention group, pre-intervention levels of parent support and child academic skills each predicted higher-quality implementation of the home learning materials, as rated by home visitors, suggesting that they might enhance outcomes (Bierman et al., in press). At the same time, within-group analyses are uncontrolled comparisons that are subject to selection biases. This study compared the associations between pre-intervention and post-intervention levels of parent support and child literacy skills across the intervention and control groups, retaining the power of the randomized design to detect moderation effects on parent and child outcomes. In addition, recognizing that parent and child effects likely interact when parents tutor their children, this study used a rigorous path analytic cross-lag approach that explored concurrent changes in levels of parent support and child literacy skills that occurred over the course of the intervention.

Based on findings from available studies, the logic model guiding the intervention suggested that child skill acquisition would be greatest when parents used positive support strategies as they engaged in learning activities with their children (Bierman et al., 2014).

Correspondingly, it was hypothesized that pre-intervention parent support levels would moderate child literacy outcomes, with higher levels of parent support at pre-intervention associated with the enhanced acquisition of child literacy skills. It was further hypothesized that children with lower literacy skills at pre-intervention would show the greatest gains with intervention (Anthony et al. 2014). Given the mixed findings on parent skill acquisition, it was unclear whether higher (Bakermans-Kranenburg et al., 2005) or lower (Beauchaine et al., 2005) levels of parent pre-intervention support might enhance intervention gains in parent support. Hence, no specific hypothesis was made regarding the moderation of parent outcomes.

Methods

Participants

In the fall of two successive years, parents of all 4- and 5-year-old preschool children attending 24 Head Start centers using the REDI classroom program in three counties of Pennsylvania received letters inviting them to participate in a study comparing two parent support programs (home visiting or mail-home materials). Offering two forms of intervention made it possible to recruit and retain parents with similar levels of interest in helping their child at home in the intervention and control group, with randomization to condition occurring at the level of the individual child after study recruitment and pre-intervention assessment. Interested parents were visited in their homes and provided informed consent for study participation. Fifty-two percent of the eligible population consented to participate. Pre-intervention assessments were conducted and families were randomized to condition at the level of the child (within Head Start classrooms) until cell sizes were full. All teachers were using the REDI classroom program, so this design evaluated the added value of the REDI-P program.

The final sample included 200 children (mean age at time 1 = 4.8 years; 55% girls; 20% Hispanic, 25% African-American, 55% European American; $n = 95$ intervention group, $n = 105$ control group). Participating parents were 89% mothers, 4% fathers, 5% grandmothers, and 1% other (e.g. relative, stepparent, or foster parent). Most parents had a high school education or less (86%) and were low-income (average annual median income of \$18,000; 54% unemployed). Slightly over one-third of the sample (36%) were single parents; the others were married (36%) or living with a committed partner (25%).

Intervention Procedures

REDI-P included 10 home visits during the spring when the child was in Head Start and 6 “booster” sessions during the fall after the child transitioned into kindergarten. All home visits followed a well-specified manualized curriculum, with topics and evidence-based teaching strategies selected to coordinate with and extend the Head Start REDI classroom program and focused on the domains of language-emergent literacy skills and social-emotional skills (Bierman et al., 2008). During home visits, parents were provided with activity boxes containing books, learning activities and games. Using instructions and videotape models, parents were shown how to use dialogic reading strategies (Whitehurst et al., 1994) and they were provided with stories that included embedded questions to support interactive reading and parent-child conversations. Parents also received guides for parent-child dramatic play designed to increase child exposure to print. For example, materials for “playing restaurant” at home included a brief book with a play script describing play roles, an alphabet soup letter identification game, menu sight words, and opportunities to practice writing when taking restaurant orders. Similar parent-child play guides and activity materials were provided for playing post office, grocery store, and being a storyteller. To encourage high levels of parent support when using the REDI-P home learning materials, home visitors showed videotaped models of the supportive parenting skills and discussed them with parents, giving the parents “tip sheets” highlighting key support strategies (e.g., showing interest, listening, encouraging with specific praise). At three points during the program,

home visitors videotaped the parent and child interacting with program materials, and then reviewed these videotapes with parents to discuss the quality of the parent-child interaction and increase parent support.

To maintain fidelity of program implementation, home visitors attended training sessions held at the start of the program (3 days) and mid-way through the program (2 days), and also participated in weekly group and individual supervision meetings with the intervention supervisor to report on their progress and get feedback regarding any implementation challenges. In addition, the supervisor attended 20% of the home visits to assure standard implementation across the various home visitors. Implementation data provided by the home visitors revealed that 80% of parents received almost all of the home visits during the Head Start year (at least 8 out of 10) and 65% of families received almost all of the home visits (at least 5 out of 6) after the transition to kindergarten. Only 11% of families were minimally engaged across both time periods (e.g., fewer than 8 preschool visits and fewer than 5 kindergarten visits). Intervention families who spoke Spanish were provided with a Spanish-speaking home visitor and offered home learning materials translated into Spanish; however, all families in this sample chose to use the English home learning materials with their children. In the control condition, parents received 4 packets in the mail (2 during the Head Start year and 2 during the kindergarten year) containing math games and instructions for use with their child.

Data Collection Procedures

The current study used pre-intervention assessments collected during October-December of the Head Start year (time 1) and post-intervention assessments collected during February-April during the kindergarten year (time 2). At each time point, research assistants visited the home to interview parents and to video-tape structured parent-child interaction tasks (described below). A bi-lingual interpreter accompanied the assessment team for the 16% of families who spoke Spanish at home. At each time point, child assessments were conducted at school by a trained research assistant during individual 'pull-out' sessions. Children were excluded from the study only if they lacked sufficient English or had a disability that prevented them from completing the assessments. Research assistants visited teachers at school to explain the rating forms; teachers completed these measures on their own and then returned them to the project. Parents were compensated \$50 for each assessment; teachers were compensated \$10 per child.

Measures

Assessment procedures were identical for families in intervention and control conditions, and were conducted by research assistants who were naïve regarding intervention condition.

Parent support—Observers rated parent support from videotapes of a parent-child book-reading task and a teaching task (doing tangram puzzles) collected during home visits. Three research assistants (who were not part of the home visit team) used a set of ratings developed for this study, designed to parallel a system used in the larger project to code teacher-child interactions in the classroom, the *Classroom Language and Literacy Environment Observation* (CLEO; Holland Coviello, 2005). Coders watched the videotape

three times to become fully acquainted with the parent and child, and then rated the quality of parent support for learning during each task using six items. These items tapped: parent warmth (e.g., “Verbal interactions are warm and carry the emotional tone of a loving relationship”), sensitive responsiveness (e.g., “The parent follows the child’s interests and foci of attention and responds promptly and sensitively to child’s initiations”), child-centeredness (e.g., “Parent is willing to make the activity child-centered and demonstrates more concern with the child’s interest and involvement in the activity than her own”), emotional support (e.g., “Parent encourages child to express feelings particularly when frustrated and engages the child to use self-control techniques to regulate emotions”), parent gratification (e.g., “Parent genuinely enjoys participating in the activity with the child”) and parent communication style (e.g., “Parent adopts a child-centered interactive style that is conversationally responsive to the child and maintains the topic that the child has initiated”); $\alpha = .93$. These items were each rated with a 5-point scale.

Prior to completing ratings, video coders attended a 2-day training session and worked with a set of practice tapes for several weeks until they established agreement with the master coder. They were required to achieve a minimum of 80% agreement on all coding categories on three separate tapes prior to coding data independently. Over the course of the coding process, reliability with the master coder was then checked for 20% of the videos for each rater to remediate any observer drift. Overall inter-rater percent agreement ranged from .87 to .96.

Child emergent literacy skills—Two measures were used to assess child emergent literacy skills at each time point. At the preschool assessment, children’s emergent literacy skills were assessed using subscales from the Pre-CTOPP early version of the *Test of Preschool Early Literacy* (TOPEL; Lonigan, Wagner, Torgesen & Rashotte, 2007). The *Blending* subtest assessed children’s capacity to combine different parts of a word and say the full word or point to the correct picture. For example, children were given “b” and “air” or “hot” and “dog” and asked to combine the sounds to make words ($\alpha = .86$). For the *Elision* subtest, children were asked to separate the sounds in compound words. For example, children were asked to, “Point to ‘snowshoe’ without ‘snow’” or “Say ‘airport’ without ‘air’” ($\alpha = .83$).

At the kindergarten assessment, emergent literacy assessments included The *Letter-Word Identification* subscale of the Woodcock-Johnson Tests of Achievement III – Revised (Woodcock, McGrew, & Mather, 2001) which assessed children’s letter recognition and basic sight word knowledge; total standard scores were used in the analyses ($\alpha = .90$). It also included the *Letter Naming Fluency* subscale of the DIBELS (Good, Gruba, & Kaminski, 2001), in which children were presented with a page of upper- and lower-case letters arranged in random order and asked to name as many letters as they could. Their score was the number of letters named correctly in one minute ($\alpha = .93$). In an extension of this activity, children were then asked to provide the sound made by each letter. They received a score reflecting the number of correct letter sounds provided in one minute. These two scores were each standardized within the sample and averaged to form a *DIBELS Letter-Sound* score.

Results

Descriptive Analyses

Descriptive statistics for the intervention and control groups including means, standard deviations, and number of participants for all study measures are presented in Table 1. Correlations are presented in Table 2. The two measures of parent support (book reading task and teaching task) were significantly correlated ($r = .54$ pre-intervention, $r = .55$ post-intervention), and were moderately stable over time ($r = .40-.28$). The two measures of child emergent literacy skills were also significantly correlated at each time point ($r = .44$ pre-intervention, $r = .48$ post-intervention) and significantly associated over time (r s ranged from $.19-.48$). Measures of parent support were not significantly associated with measures of phonological awareness in Head Start but were significantly associated with literacy skills (letter identification, letter-sound associations, sight words) assessed in kindergarten (r s = $.16-.20$).

Multi-group Cross-Lag Structural Equation Models

To determine whether intervention amplified or diminished the longitudinal stability or cross-lag associations of parent support or child literacy skills, multi-group structural equation models (SEM) were computed, following Byrne (2001). These analyses were performed with SPSS 19 and AMOS 20, which used maximum likelihood estimates to account for missing data. Only small amounts of data were missing at time 1 (median = 2%; range = 0 - 8%) with slightly more missing data at time 2 (median = 9%; range = 5 - 16%) at time 2. Child race, child gender, and family SES (which included family income and maternal education) were included in the model as control variables. In order to preserve the power of the randomized design, analyses used an intent-to-treat approach, with all families included regardless of the amount of intervention received. It was deemed unnecessary to include Head Start or kindergarten classrooms as nesting factors in these models because there was little evidence of data dependency; ICCs were negligible for parent support, and very small for child emergent literacy scores (Head Start ICC = $.16$; elementary school district ICC = $.15$). In addition, children were randomly assigned to intervention-control condition within Head Start classrooms and children were widely dispersed in across 145 kindergarten classrooms, most having only one REDI participant), so that classroom placement was not confounded with group status.

To determine whether the factor loadings or structural paths in these models differed for the intervention vs. control group, models that constrained values across groups were compared systematically with models that allowed values to vary across groups. Chi-square difference tests showed that the fully constrained model was significantly different from the unconstrained model, χ^2 ($df = 10$, $N = 200$) = 17.94 , $p = 0.05$, and further revealed that the optimal model retained the same measurement model across groups (e.g., constrained the factor loadings of measures representing constructs to be the same), but allowed the structural paths to vary for the intervention and control groups (see Figure 1).

To identify the best-fitting structural model, constraints were systematically lifted on each of the structural paths until all possible combinations were evaluated, and the fit indices were

compared. These analyses determined that there were two models that fit better than the others (see Table 3). The first model allowed the path from pre-intervention to post-intervention parent support to vary across the intervention and control groups. The second model also allowed the cross-lag path from pre-intervention parent support to post-intervention child literacy skills to vary across the intervention and control groups. A chi-square test compared the fit of these two models and determined that the model fit was equivalent for the two models, χ^2 (df = 1, N = 200) = 1.48, p = 0.22. The final model (see Figure 2) thus demonstrated two significant differences in parent-child transactions over time in the intervention vs. control groups. First, parent support changed more from pre-intervention to post-intervention for parents in the intervention group, whereas it was more stable for parents in the control group. Second, parent support at pre-intervention was more strongly and significantly associated with post-intervention child emergent literacy skill outcomes for families in the intervention group, whereas this association was non-significant in the control group.

Follow-up Analyses

Next, follow-up analyses were conducted in order to better understand whether and how the SEM pathways that differed across intervention and control groups represented moderated intervention effects associated with pre-intervention parent characteristics. The SEM models demonstrated that intervention significantly decreased the stability of parent support. To determine whether this decreased stability was associated systematically with parent's initial levels of support, parents were categorized into two subgroups using median splits. Then, intervention effects on parent support were compared for those subgroups (e.g., parents high vs. low in pre-intervention support). As shown in Figure 3, among the parents with low pre-intervention levels of support, planned contrasts confirmed a significant intervention effect on post-intervention levels of support, M (SD)_{intervention} = 3.02 (.74) versus M (SD)_{control} = 2.54 (.63), p = .006. In contrast, among the parents with higher initial levels of parent support, no significant intervention effect emerged. Thus, the differential stability of parent support in the SEM model was explained by amplified increases in parent support over time in the intervention group (relative to the control group) among those parents who initially had low levels.

A similar set of follow-up analyses was conducted to explore the differential association between pre-intervention parent support and post-intervention child literacy skills evident in the SEM models comparing the intervention and control groups. The different measures used to assess child emergent literacy skills at each time point were standardized within the sample to create an index that was comparable across the two time points. Change scores were created by subtracting standardized pre-intervention scores from post-intervention scores. Changes in child literacy scores were then compared for the subgroups of parents who were high vs. low in support at pre-intervention (determined by median split, as described above). Mean change scores are graphed in Figure 4. This graph reveals a significant intervention effect on child literacy skills when parents had high levels of support at pre-intervention assessments. Group contrasts showed that children in the intervention group who had supportive parents gained more in emergent literacy skills than did children in the intervention group who had low supportive parents, M (SD)_{high support intervention} = .25

(.98) versus $M (SD)_{\text{low support intervention}} = -.19 (.93)$, $p < .05$, and tended to gain more than children in the control group who had parents low in support, $M (SD)_{\text{low support control}} = -.24 (.86)$, $p = .01$ (see Figure 4). (When these analyses were conducted using the post-intervention child literacy scores with pre-intervention emergent literacy scores serving as covariates, results were equivalent.) These findings suggest that the intervention amplified the impact of initial parent support on later child literacy skill development, and further suggest that child gains in literacy skills were greatest when parent-child interactions were characterized by high levels of parent support at the start of the intervention.

Discussion

Providing parents with a home learning curriculum and coaching them in the use of evidence-based teaching strategies may be an effective way to promote gains in child emergent literacy skills at the kindergarten transition, but some evidence suggests attenuated benefits for children when their parents have socio-economic risks (Manz et al., 2010; Mol et al., 2008). The REDI-P intervention tailored home learning materials specifically for low-SES families with children attending Head Start, producing enhanced literacy skills for children but no overall change in parent support for learning, relative to a control group (Bierman et al., in press). This study explored variations in REDI-P intervention impact, to better understand how initial parent and child skills may have moderated parent and child outcomes. Pre-intervention levels of parent support for learning emerged as an important moderator of intervention impact, with higher baseline parent support predicting greater gains in child literacy skills and lower baseline parent support predicting greater gains in parent support for learning. These findings and their implications are discussed in the following sections.

Pre-intervention Parent Support Moderated Child Literacy Skill Outcomes

A prevailing concern regarding the use of parents as tutors for their young children is that such programs may over-burden parents in low SES families who often have limited education and resources, and may not provide sufficient support for learning in the context of tutoring interventions (Brooks-Gunn & Markman, 2005; Manz et al., 2010). In the present study, intervention amplified the impact of pre-intervention parent support on child literacy outcomes, as shown by the SEM multi-group cross-lag models. When parents displayed higher levels of support during pre-intervention book-reading and teaching tasks, their children benefitted from the intervention, showing significant gains in literacy skills. In contrast, intervention effects on child literacy skills were smaller and non-significant when parents displayed low levels of support at pre-intervention assessments. Prior implementation analyses of the REDI-P program showed that, within the intervention group, pre-intervention levels of parent support predicted the quality of implementation of the home learning materials, as rated by home visitors (Bierman et al., in press). The present study extends beyond these analyses, documenting that pre-intervention levels of parent support also moderated intervention impact on child literacy outcomes relative to the control group. An important feature of the present analyses was the inclusion of the control group, which allowed the study to retain the power of the randomized design and draw stronger causal inferences about the impact of pre-intervention parent support on child outcomes than

within-group analyses of implementation quality alone. Together, these analyses suggest that parents who were warm and supportive at the start of the intervention were more able than the less-supportive parents to use the home learning materials effectively with their children, perhaps more effectively engaging their children in the learning activities and more sensitively supporting their learning efforts. Without intervention, parent support was not sufficient to promote child emergent literacy skills, but being supportive enabled parents to effectively engage in dialogic reading and playful learning activities with their children when they were given the REDI-P scripted home learning materials. These findings are consistent with other parent-focused interventions for preschool children, in which children in the intervention condition made more gains in language-literacy skills when they had lower-risk parents (Mol et al., 2008; Sheridan et al., 2011).

The findings are also consistent with developmental research, in which parent emotional support and sensitive responsiveness has been linked with child self-regulation and attention control and associated with behavioral and cognitive school readiness (McCabe, Clark, & Barnett, 1999; Hughes, 2011). They validate the logic model of home visiting programs that seek to promote parent support, but also suggest that supportive parents may need tailored home learning materials and coaching in evidence-based teaching strategies to promote the emergent literacy skills of their children.

Pre-intervention Parent Support Moderated Parent Support Outcomes

The opposite pattern of moderation emerged for parents. That is, cross-lag, multi-group SEM showed that parent support was less stable over time and changed more in the intervention than in the control group. Follow-up analyses showed that the instability in the intervention group was due to improvements in support by parents who were initially low but improved over the course of the intervention. Although pre-intervention levels of parent support were thus a moderator of intervention effects on both child and parent outcomes, the direction of effect was opposite. These findings illustrate the importance of considering moderation effects on both parent and child outcomes together. Had the analyses focused only on child outcomes, the program would appear useful only to supportive parents who could effectively teach their children at home. However, these analyses revealed that parents who were low initially in support also benefited from the program, becoming more warm and supportive over time. Rather than the dual effects occurring together as hypothesized (e.g., parents become more supportive over time and thereby effectively teach their children), these findings suggest that families may benefit from home visit school readiness interventions in two different ways, with child skill acquisition greatest when parents are initially high in support, and parenting improving most when parents are initially low in support.

Rarely has the logic model underlying home visiting programs been tested directly, to determine whether intervention gains in parent support mediate child gains in school readiness outcomes. When Madden et al., (1984) explored these associations for the Parent-Home Program, they found significant improvements in parenting skills (maternal verbal interaction during videotaped tasks) and small improvements in child skill acquisition (IQ), but these gains were not correlated; improved parenting behavior did not mediate the

intervention effect on child outcomes. In addition, in a variation of the program, toys and books were supplied for home use without concurrent home visits designed to promote parenting skills. Providing home learning materials was as effective as the full program in terms of promoting child skill acquisition, but had no effect on maternal behavior, further suggesting different intervention mechanisms operating to promote child versus parent intervention outcomes. Although there are a number of differences that make it hard to compare these Parent-Child Home Program findings with the current results, they have in common the finding that parents and children appear to benefit in different ways from the intervention, rather than parent benefits mediating child benefits.

Indeed, parenting programs differentially affecting parents and their children is consistent with a larger theoretical literature on dual generation programs which seek to build interventions components that serve both parents and children rather than addressing them individually (Haskins, Garfinkel, & McLanahan, 2014). In addition to program components that seek to improve child cognitive and social-emotional outcomes, dual generation programs also include components designed to improve that parent's station and well-being (e.g. reduce parent stress, improve parent health, and increase parent employment). However, the notion that children and parents are each benefitting separately is different from an expectation that gains in parent skills will translate into and mediate positive child outcomes, which is often expected in home visiting programs targeting child school readiness but rarely tested and rarely confirmed (Caughy, Huang, Miller, & Genevro, 2004; Madden et al., 1984, but in contrast see Landry et al., 2006).

Method of Analysis

Within-group analyses are often used to link home visit program implementation quality with later child outcomes, in order to demonstrate that parental use of program strategies is linked with positive child outcomes (Johnson, Martinez-Cantu, Jacobson, & Weir, 2012). However, such analyses are complicated by biases associated with the parenting and child characteristics that predict implementation quality. In these within-group analyses, one cannot tell the degree to which program implementation itself, or alternatively, the parent and child factors linked with program implementation are associated causally with the child outcomes. In the present study, the use of SEM cross-lagged models retained the strengths of the randomized design by including the control group, thus supporting causal interpretations. The design also allowed for teasing apart the direction of the association between pre-intervention and post-intervention levels of parent and child skills, simultaneously accounting for parent and child effects, as well as determining how these associations were moderated by intervention.

Limitations and Future Directions

This study focused on how parent's pre-intervention levels of support affected the impact of the REDI-P school readiness program. However, the specific manner in which higher levels of parent support amplified REDI-P impact on child literacy skills remains elusive. Parent support is correlated with a number of aspects of parenting skill and parent-child interaction quality that may have accounted for the findings. For example, some families take a more active approach to learning development and provide more opportunities for learning, talk

with their child more and are more involved in their children's school and academic learning, whereas other families have been found to structure fewer learning experiences and use less complex and varies language, instead preferring a more hands-off approach to development (Cheadle, 2008). The index of parent support used in this study may well be a proxy for other important dimensions of parent support for learning that were not measured directly in this study. In addition, there could be other qualities of the parent, not studied here, that might affect how successful parents are at implementing a school readiness program.

A second limitation of this study was its focus on the moderation of just one domain of child outcome – emergent literacy skills. REDI-P also produced significant intervention effects on teacher-rated academic performance, and on two teacher-rated measures of social-emotional functioning -- self-directed learning, and social competence (Bierman et al., in press). When the moderation model used in this study was applied to these teacher-rated outcomes, the pattern of effects appeared similar, but the follow-up tests did not show statistically-significant patterns of moderation. It is possible that the difference in findings reflects the measurement methodology. That is, whereas emergent literacy skills were measured with the same direct assessments at each time point, the teacher ratings were completed by different teachers in different classroom contexts (Head Start vs. kindergarten) at each time point, likely providing a less precise assessment of child skill acquisition. Alternatively, the pattern of moderation observed here for emergent literacy skills may not carry over to other child outcomes. The failure to replicate the moderation findings on these other REDI outcomes is a limitation of the study and an indicator of the need for further process research of this kind.

In addition, future studies should test empirically the longer term effects of this kind of intervention on child outcomes. For example, analyses of children's literacy skills one year following the end of intervention could determine whether parents who were initially low in support became more effective at supporting their children's literacy skills after intervention fostered increases in parent warm support. In addition, future studies should consider exploring other potential moderators of home visiting interventions including moderators at the child level (e.g. language skills, temperament, regulatory capabilities) as well as at the parent level (e.g. language spoken in the home, parenting stress). This study did not find that pre-intervention levels of child emergent literacy skills moderator intervention impact on child emergent literacy skill acquisition – an effect that was expected based on prior studies (Anthony et al., 2014; Sheridan et al., 2011). Further research is needed to determine the conditions under which child pre-intervention characteristics may moderate their response to a home visiting intervention such as this one, or whether child skills have an impact on parent response to intervention. Moderation analyses of this kind would contribute to building a more fine-grained account of the process by which home visiting interventions are effective.

Of particular importance to future research is the examination of intervention acceptability and impact for families of varied racial and ethnic backgrounds, especially children and parents who are English language learners (Manz et al., 2010). Although the present study utilized a diverse sample, a key limitation was that the sample was not sufficiently large to

support analyses of differential intervention effectiveness among the participating racial/ethnic groups. In addition, in this Pennsylvanian sample, all of the participating Latino families chose to use English language intervention materials. Latinos in other regions, or more recent immigrants, may have different preferences. Given prior research that suggests important racial/ethnic variations in beliefs, attitudes, and behaviors associated with parental involvement in child education (Manz et al., 2010; Mendez, 2010; Waanders, Mendez, & Downer, 2007), this is an important moderator to explore in future research.

Overall, the present findings suggest that providing low-income parents with a home learning curriculum and coaching them in evidence-based teaching strategies can be a useful way to expand the impact of early childhood classroom programming. However, the findings also point to the need for additional research to determine whether the associations that emerged in this study are unique to the REDI-P program or whether they are more broadly representative of moderators of parent-implemented school readiness programs. A better understanding of the mechanisms of action (moderators and mediators) that characterize parenting programs that effectively promote child school readiness could inform intervention design and improve impact, with far-ranging benefits for the families involved and society more generally.

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Figure 1.

Optimal Multi-Group Measurement Model for Intervention and Control Groups

Note. In multi-group SEM analyses, equality constraints are imposed on unstandardized coefficients but standardized coefficients are shown above to aid interpretation.

Figure 2.

Multi-Group Cross-lag Structural Models for Intervention and Control Groups

Note. Dotted pathways were allowed to vary freely, solid pathways were held constant across intervention and control groups. Control variables (not depicted) include: child race, child gender, and family SES. * $p < .05$. ** $p < .01$.

Figure 3.

Changes in Parent Support by Initial Support Levels and Group Assignment

Note. * $p < .05$, ** $p < .01$.

Figure 4.

Intervention Gains in Child Literacy Skills with Parents Initially High vs. Low in Support

Note. In the top panel, parent support is assessed with videotaped tasks; in the bottom panel, parent support is assessed at the home visit * $p < .05$, ** $p < .01$.

Table 1

Descriptive Statistics for Parent Support and Child Literacy Skills

Parent and Child Characteristics	Pre-intervention			Post-intervention		
	Intervention Group	Control Group	Control Group	Intervention Group	Control Group	Control Group
	Mean	(SD)	N	Mean	(SD)	N
<u>Parent Support</u>						
Book Reading Task	3.08	(.84)	84	3.10	(.85)	98
Teaching Task	3.17	(.81)	83	3.07	(.82)	97
<u>Child Literacy Skills</u>						
Elision	8.98	(4.35)	94	8.77	(4.24)	105
Blending	11.95	(4.45)	95	12.53	(4.60)	105
Letter-Word ID				106.4	(10.6)	89
DIBELS				30.4	(16.6)	89
						101

Table 2

Correlations among Study Variables

	1.	2.	3.	4.	5.	6.	7.
1. Book Reading Task - Pre	--						
2. Book Reading Task - Post	.40**	--					
3. Teaching Task - Pre	.54**	.26**	--				
4. Teaching Task - Post	.28**	.55**	.28**	--			
5. Elision - Pre	.11	-.02	-.01	-.06	--		
6. Blending - Pre	.12	.11	.01	.03	.44**	--	
7. Letter-Word ID - Post	.16*	.20**	.06	.00	.26**	.34**	--
8. DIBELS - Post	.20**	.18*	.14	.05	.20**	.19*	.48**

Note. Pre = Pre-intervention, Post = Post-intervention.

**
p < .01

*
p < .05

Table 3**Model Fit Statistics for Best Fitting Cross-lag Models**

Model Characteristics	Model Fit Indices	
	CFI	RMSEA
<u>Fully Unconstrained and Constrained Models</u>		
Unconstrained	1.00	.00
All Weights Constrained to be Equal	.97	.02
All Weights and All Paths Constrained to be Equal	.95	.03
<u>Models With Specific Paths Allowed to Vary</u>		
1. Parent Support (Pre) to Parent Support (Post)	.98	.02
2. Child Literacy (Pre) to Child Literacy (Post)	.94	.03
3. Child Literacy (Pre) to Parent Support (Post)	.94	.03
4. Parent Support (Pre) to Child Literacy (Post)	.95	.03
5. Parent Support (Pre) to Parent Support (Post) and Parent Support (Pre) to Child Literacy (Post)	.98	.02

Note. Tests compared the fit of all possible combinations of varying pathways and varying pathway combinations. Only the best-fitting models are shown here. Model fit is better with a larger CFI and a smaller RMSEA. Pre = pre-intervention; Post = post-intervention.