The relation of maternal emotional and cognitive support during problem solving to pre-academic skills in preschoolers

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Abstract:

Using a sample of 263 mother–child dyads, we examined the extent to which maternal emotional and cognitive support during a joint problem-solving task when children were 3-years-old predicted children's academic skills 1 year later independent of each other, the quality of the home learning environment, and maternal emotional responsiveness. When all parenting measures were examined simultaneously, only maternal emotional support during problem solving and the quality of the home learning environment predicted unique variation in gains in pre-academic skills from 3 to 4 years of age. The positive effect of emotional support during problem solving was especially apparent for children whose pre-academic skills were low at the age of 3 years. These findings are discussed in light of the changing demands placed on young children and their parents as they prepare for entry to the formal school system.

Keywords: mother–child relations | academic readiness | school readiness | parenting | preschoolers

Article:

School readiness includes both academic and social emotional skills and has been linked to children's early academic achievement (see Meisels, 1999; Rimm-Kaufman, Pianta, & Cox, 2000). In two recent meta-analyses, children's early academic skills (i.e. math, reading, and attention/work habits) were identified as particularly robust predictors of children's subsequent academic achievement (Duncan *et al.*,2007; La Paro & Pianta, 2000), and when considered simultaneously, academic skills predicted substantially more variation in school achievement than did early social emotional skills (Duncan *et al.*). Thus, identifying the specific types of parenting behaviours that are particularly relevant to the development of academic skills in early childhood is an important goal. The purpose of this research is to examine the extent to which

mothers' emotional and cognitive support during a problem-solving task with 3-year-old children predict change in pre-academic skills over 1 year independent of each other and other dimensions of parenting. We also examined the possibility that maternal behaviour is more predictive of pre-academic skills when children are at risk because of low initial academic skills.

Examining these questions is timely given several recent shifts in early education. Since the inception of the No Child Left Behind Act in 2001, there has been an increased emphasis on accountability and standards-based instruction and testing (Stipek, 2006). Although such testing is not required until grade 3, scholars have described the ‘accountability shovedown’ in which the emphasis on standards and didactic instruction has descended into the kindergarten classroom (Hatch, 2002; Stipek, 2006). One implication of this shift is increased academic expectations for children at school entry, such as the belief that children should know their letters and numbers on the first day of kindergarten (Bush, 2002). Parents' beliefs about teaching and learning in early childhood are likely affected by the increased attention to children's early academic skills. Given evidence that beliefs about learning are linked with how parents interact with their children (Fisher, Hirsh-Pasek, Golinkoff, & Gryfe, 2008; Stipek, Milburn, Clements, & Daniels, 1992), parents may be making more intense, didactic efforts to bolster early academic skills if they believe this is what is expected of their children in school and may unintentionally overlook their children's emotional needs while doing so. To date, few investigators have measured and retained separate parenting dimensions within problem-solving tasks to determine which are independently predictive of early pre-academic skills, and even fewer have controlled for other aspects of parenting while doing so (see Hubbs-Tait, Culp, Culp, & Miller, 2002 for an exception). Such knowledge has practical implications for parents of young children and the professionals who work with them. In this report, we focus on children's language skills, attentional skills/work habits, and knowledge of basic concepts because these pre-academic skills have been found to be most predictive of academic achievement (Duncan *et al.*, 2007) and are increasingly expected of young children at school entry.

LINKS BETWEEN PARENTING AND PRE-ACADEMIC SKILLS

A variety of theoretical perspectives emphasize the role of parental behaviour in the development of early academic skills. From a Vygotskian perspective (Vygotsky, 1978), young children are initially dependent on their parents for assistance in problem-solving tasks and become increasingly independent and competent over time, with practice and appropriate support. This perspective emphasizes the importance of parental scaffolding, or the provision of both cognitive support (providing information about a task, generating concrete strategies, breaking a task into manageable steps) and emotional support (encouraging the child's autonomy, providing encouragement and praise, managing frustration) during tasks that are beyond the child's ability level (Neitzel & Stright, 2003; Rogoff, 1990). Parents' cognitive and emotional support should enhance a child's ability to learn and to subsequently solve problems independently, thereby enhancing their academic skills, and prior research supports this view. For example, the quality of mother–child interaction, defined to include both emotional and cognitive support during

problem solving tasks at kindergarten entry, was positively associated with teachers' reports of children's later behavioural and academic competence (Pianta & Harbers, 1996; Pianta, Smith, & Reeve, 1991), and a similar measure of scaffolding in first grade predicted concurrent cognitive functioning independent of prior cognitive skills (Mulvaney, McCartney, Bub, & Marshall, 2006). Likewise, mothers' and fathers' support for autonomy (an aspect of emotional support) assessed during problem solving tasks from 54 months to grade 3 were associated with greater gains in boys' reading and math achievement from first to third grade and with greater self-reliance (i.e. initiative, active engagement, and persistence) independent of earlier child achievement (NICHD Early Child Care Research Network, 2008).

These studies demonstrate that parenting behaviours during problem-solving tasks are linked with children's subsequent academic skills. However, these results do not clarify the relative importance of emotional versus cognitive support in problem-solving contexts, nor do they rule out the possibility that such effects are merely a function of more general features of positive parenting. In particular, it may be that parents who provide more cognitive support in problem solving contexts provide more cognitive stimulation in general and parents who provide more emotional support during problem-solving contexts are more emotionally responsive in general, and it is these more general features of parenting that in fact promote child competence.

Given compelling evidence that the amount and quality of stimulating materials in the home (e.g. books, toys that promote problem solving) and stimulating activities orchestrated by parents (e.g. reading time, trips to the library) are linked with children's subsequent academic skills and performance (e.g. Bradley, 2002; Forget-DuBois *et al.*, 2009), it is important to evaluate the extent to which parental support during problem solving predicts unique variation in school readiness beyond the level of cognitive stimulation provided by parents in the home.

Similarly, prior evidence supports positive links between parents' emotional responsiveness and school readiness. For example, maternal sensitivity early in life is linked with better language and math skills among 4 year old and kindergarteners (Lunkenheimer *et al.*,2008; Rimm-Kaufman, Pianta, Cox, & Bradley, 2003). Such effects can be explained by the attachment theory perspective that children whose parents respond to their bids for safety and protection in a consistently positive manner develop an internal working model of themselves as competent and the world around them as safe and responsive to their needs (Bowlby, 1973). This, in turn, contributes to a child's willingness to explore the environment which should enhance a child's learning-related skills, such as autonomy, initiative, and persistence, and may enhance early academic skills by virtue of this greater exploration. As elaborated below, the extent to which emotional support during problem solving exerts an effect on academic readiness beyond more general emotional responsiveness remains unclear.

UNIQUE EFFECTS OF SPECIFIC PARENTING DIMENSIONS ON EARLY ACADEMIC SKILLS

No single study to date has simultaneously examined cognitive and emotional support in problem-solving tasks, the quality of the learning environment provided at home, and general emotional responsiveness to learn which are uniquely predictive of early academic skills. Several studies have examined two of these aspects simultaneously, shedding some light on the relative importance of each dimension of parenting in relation to early academic skill development. For example, two studies have simultaneously tested the impact of cognitive and emotional support during problem-solving tasks on relevant outcomes. Barocas *et al.* (1991) reported independent associations between maternal cognitive and emotional support and children's attention, which in turn predicted children's cognitive skills. Likewise, Neitzel and Stright (2003) reported that aspects of both emotional and cognitive support predicted task persistence and behavioural control, whereas only cognitive support predicted self-monitoring in a learning situation.

Results from two studies that examined the simultaneous impact of more general measures of emotional responsiveness and cognitive stimulation were mixed. In one study, cognitive stimulation in the home and parental responsiveness were independently positively associated with vocabulary, math, and reading over and above demographic variables (Bradley, Corwyn, Burchinal, McAdoo, & Garica Coll,2001), but in the other study, emotional support was a unique predictor of children's reading while the home learning environment was not (Merlo, Bowman, & Barnett, 2007). Finally, two studies were located that examined a more general aspect of parenting and at least one type of support during a problem-solving task. In the first study, emotional responsiveness during a non-problem solving task and cognitive support during a teaching task (provision of information) predicted school readiness independent of each other and the child's earlier abilities (Hess, Holloway, Dickson, & Price, 1984). In the other study, emotional and cognitive support during a problem-solving task and general emotional responsiveness (comfort) each predicted unique variation in children's perceptual skills independent of the child's prior verbal skills, whereas none of these parenting dimensions were independent predictors of children's gains in verbal skills (Hubbs-Tait *et al.*, 2002).

Thus, there are mixed findings as to whether maternal emotional support and cognitive support during challenging tasks, the provision of a cognitively stimulating home learning environment, and general maternal emotional responsiveness predict gains in academic skills independent of one another. The discrepant findings may reflect the fact that the studies differed in a number of ways including the risk characteristics of the sample (Barocas *et al.*, 1991; Merlo *et al.*, 2007 used high risk samples), different types of child outcome variables (e.g. school readiness, reading skills, observed behaviour in a learning situation), and different approaches to the measurement of parenting (e.g. observed, self-reported, a blend of both). In the current study, we predict that each of these dimensions of parenting will correlate positively with pre-academic skills and that the effects of support during the problem-solving context will be independent of the more general measures of parenting because it is in this context that parents provide children with specific strategies and feedback about how to approach a problem, assess and alter

strategies, and maintain interest, attention, and composure, all of which should be uniquely related to the acquisition of early academic skills.

PARENTING CHILDREN AT RISK FOR ACADEMIC DIFFICULTIES

Finally, the extent to which maternal emotional support and cognitive support during challenging tasks predict subsequent pre-academic skills for different subgroups of children remains unclear. Given that early intervention efforts tend to focus on children considered at risk for school difficulties, it is particularly important to understand the types of parenting that yield the greatest increase in academic skills for these children. Such information may guide the design and implementation of parenting components of early intervention efforts. Thus, we examine the possibility that children's initial academic skills moderate the relations between maternal emotional and cognitive support during problem solving and subsequent academic skills. Specifically, children whose initial academic skills are low may be more dependent on parental assistance during problem solving for the development of pre-academic skills because these tasks are more difficult and frustrating for them than for children who are more skilled. Consistent with this view, maternal stimulation and responsiveness were more important to early reading skills for children with lower initial cognitive abilities (Taylor, Anthony, Aghara, Smith, & Landry, 2008), maternal control had a greater negative impact on the development of attentional control among children who were more negative (Gaertner, Sprinrad, & Eisenberg, 2008), and maternal cognitive stimulation had a greater positive effect on non-verbal skills among pre-term children (Smith, Landry, & Swank, 2000). Likewise, among older children, emotionally supportive maternal behaviour during challenging tasks has been linked with children's better performance, higher engagement, and more interest in and liking for school, particularly among children with lower initial competence (Ng, Kenney-Benson, & Pomerantz, 2004; Pomerantz, Ng, & Wang,2006).

THE PRESENT STUDY

In the current study, we examined the impact of maternal provision of emotional support and cognitive support during a problem-solving task, the quality of the home learning environment, and general emotional responsiveness at age 3 on children's pre-academic skills at age 4 while controlling for pre-academic skills at age 3. Thus, reported associations reflect change in pre-academic skills from age 3 to 4 as a function of parenting. We tested the following hypotheses: (1) Children of mothers who provide more emotional support and cognitive support in a problem-solving task, a better quality home learning environment, and more general emotional responsiveness at age 3 will have higher pre-academic skills at age 4, controlling for earlier pre-academic skills; (2) the positive effects of emotional and cognitive support during problem solving on pre-academic skills will be independent of emotional responsiveness and the quality of the home learning environment; and (3) emotional and cognitive support during problem solving will be more strongly positively associated with pre-academic skills among children with lower pre-academic skills at age 3.

METHODS

Participants

The sample consisted of 263 children and their mothers who participated at age 3 and 4 in a longitudinal study examining emotional and cognitive contributions to early school success. At the first wave, mothers were 33 years of age on average (S.D. = 5.91). Approximately 51% had a 4-year college degree or higher; 74% of the respondents were married and living with their partner; and 79% were currently working outside the home. Average income-to-needs ratio, derived by dividing the total family income by the poverty threshold for that family size was 2.89 (S.D. = 1.73); approximately 37% of the sample had an income-to-needs ratio of less than 2.0, indicating low income; 53% had between 2 and 5; and 10% had greater than 5. Sixty-one percent of the mothers were European American, 31% African American, and 8% other ethnicities, including mothers of mixed ethnicity. Fifty-two percent of the children were female.

Of the 263 original participants, 244 returned for the 4-year visit, a 93% retention rate. Mothers who participated in both visits were older ($t[261] = 2.36$, $p<0.05$), more likely to be white ($\chi^2[1, N = 263] = 5.13$, $p<0.05$), more well educated ($t\,[261] = 2.43$, $p<0.05$), and provided more emotional support to their children during the problem-solving task at 3 years ($t\,[261] = 2.31$, $p<0.05$) than those who were lost to follow up. Finally, continuously participating children had higher Peabody Picture Vocabulary Test-III (PPVT) scores at the age of 3 years than did non-participating children ($t\,[261] = 1.99$, $p<0.05$). All other comparisons were non-significant.

Procedures and Measures

Participating families were recruited from preschools and childcare centres in a small Southeastern city through letters sent home with the children. Families interested in participating returned contact information to the researchers who then called the families to schedule a laboratory visit that lasted approximately 2 h. Mothers provided written consent before the start of the session. During the 3-and 4-year lab sessions, mothers completed a variety of questionnaires, mothers and children were videotaped while completing a problem-solving task, and children participated in a language assessment. Families received $40 and $60 for the 3-and 4-year visits respectively, and children selected a toy after each visit.

Socioeconomic status

Mothers reported their highest level of education, family income, and household composition at the 3-year laboratory visit. The income-to-needs ratio and maternal education were correlated significantly, $r\,(261) = 0.53$, $p<0.01$. These variables were standardized and averaged to create a single measure in which high scores indicate higher socioeconomic status.

Maternal cognitive and emotional support during a problem-solving task

Mother–child interaction was observed throughout a problem-solving task during the 3-year laboratory visit. During the *treasure game*, created for this study, the child moved a bear along a path on a game board from the start position to a treasure chest located on an island at the other end. Steps along the path were marked by colours that matched a die the child rolled to determine where to move the bear. Before getting to the treasure chest, the bear had to be moved to two other locations, in the correct order (i.e. retrieve a key to unlock the boat, take the boat across the river to the treasure). Mothers were instructed to help the child to get the treasure in the fastest way possible. The task ended when the child reached the treasure or the mother and child stopped engaging in the task. The average duration of the game was 6 min (S.D. = 2.12). The task was videotaped and later rated by two trained coders.

The frequency and quality with which mothers engaged in cognitive and emotion-oriented scaffolding behaviours were rated using a 5-point coding system adapted from Neitzel and Stright (2003) to capture the following five dimensions: (1) *Metacognitive information* reflects the extent to which the mother provided a complete and understandable overview of the game, including explanations of how to complete the game and why those steps were needed as opposed to merely focusing on individual steps; (2) *Cognitive information* eflects the degree to which the mother provided the child with appropriate information about the task at hand, including information on how to roll the die, how to match the colour on the die to a colour on the game board, and reminders of individual steps in the task; descriptions of how components of the task are used in real life; or any other information that provided an opportunity for the child to learn something or to gain understanding about the task; (3) *Emotional responsiveness* represents the extent to which the mother was sensitive, appeared to enjoy being with the child, praised or encouraged the child, anticipated and minimized potential problems, and was flexible and creative in keeping the child focused on the task;
(4) *Intrusiveness* represents the extent to which the mother gave many directions with very little time in between for her child to make decisions or take independent action, or took over large portions of the game thereby undermining her child's autonomy; and (5) *Negativity* represents the extent to which the mother displayed negative verbal or non-verbal emotions, such as direct criticism, frowning, irritability, and impatience. Inter-rater reliability on these rating scales was calculated using intra-class correlation coefficients (ICC) (Winer, 1971) based on 25% of the interactions which were double coded. ICCs ranged from $r = 0.79$ to 0.94, all $p<0.01$. In prior work, ratings of this type predicted children's kindergarten reasoning abilities and self-regulation in the classroom (Neitzel & Stright, 2003; Stright, Herr, & Neitzel, 2009).

In addition, the frequency with which mothers used *mental state language involving cognitive terms* was coded from the problem-solving task using procedures outlined by Jenkins, Turrell, Kogushi, Lollis, and Ross (2003). Eleven cognitive state terms reflecting the mother, child, or a third party's thoughts, memories, knowledge, mental state or mental strategies were counted. Nine of these were used by Jenkins *et al.* (*think, know, believe, wonder, remember, forget, guess, pretend, understand, and expect*) and two new terms were added for this

study: *confused* and *figure out*. Instances in which the mother used these words repetitively in succession or simply repeated comments made by her child were not coded. Examples of the types of comments that were common include: 'What do you think we should do next?' 'Do you remember how we unlock the door at home?' 'I wonder how the bear can get across the river.' Inter-coder reliability for the frequency counts based on 25% of the videotapes was $r = 0.92$. Given variation in session length, the frequency score was divided by task duration such that the resulting scores reflect the rate per minute that mothers used cognitive mental state language. In prior work, the frequency of parents' use of mental state language predicted their children's subsequent mental state language use and false-belief understanding (Jenkins *et al.*2003; Ruffman, Slade, & Crowe, 2002).

Quality of the home learning environment

The quality of the home learning environment was measured using two questionnaires, Watching Television, Reading, and Computers at Home (TVRC) and the Toys and Activities Questionnaire (TAQ), that were completed by mothers during the laboratory visits. The TVRC is comprised of nine items ($\alpha = 0.57$) and was adapted for the study from the home literacy environment items by Griffin and Morrison (1997). Example items include 'number of books owned by child' and 'someone reads to child at home'. The TAQ is comprised of 20 items ($\alpha = 0.65$) and was adapted for the NICHD Study of Early Child Care from the Home Observation for Measurement of the Environment (Caldwell & Bradley, 1984). Example items include 'in your home, does your child have toys that help him/her learn colours' and 'do you encourage your child to read a few words in his/her books'. As a set, the TAQ and TVRC measure the extent to which toys and learning materials are available in the home environment, the child engages with the toys and learning materials, and parents directly teach their child concepts and take their child to places and events that provide enrichment. In prior work, TVRC scores predicted kindergarteners' literacy skills (Griffin & Morrison, 1997) and the interview version of a subset of TAQ items predicted children's verbal and math skills (Bradley *et al.*, 2001).

General maternal emotional responsiveness

Mothers reported on their responses to their children's negative emotions using the Coping with Children's Negative Emotions Scale (CCNES; Fabes, Eisenberg, & Bernzweig, 1990). The CCNES includes 12 common situations in which the child is distressed (e.g. *If my child loses some prized possession and reacts with tears, I would*…). Mothers are then asked to rate the likelihood that they would respond in various ways on a 7-point scale (*1 = very unlikely, 7 = very likely*). Given that our interest was in emotional responsiveness and not emotion socialization, three subscales were selected for use: expressive encouragement (e.g. *tell him/her it's OK to cry when you feel unhappy)*, minimization reactions (e.g. *tell my child that he/she is over-reacting)*, and punitive reactions (e.g. *tell him/her that's what happens when you're not careful)*. Internal reliabilities (Cronbach's αs) for the subscales were 0.91, 0.76, and 0.71, respectively. In prior work, emotional non-responsiveness, as indicated by these scales, was

linked with children's lower effortful control (Valiente, Lemery-Chalfant, & Reiser, 2007), demonstrating predictive validity of the scales. Additionally, mothers' self-reported responses to their children's negative emotions has demonstrated convergent validity with observed indices of maternal warmth and sensitivity (Leerkes, Parade, & Gudmundson, 2011; Spinrad *et al.*, 2007).

Child pre-academic skills

Language

The PPVT(Dunn & Dunn, 1997), a nationally standardized measure of receptive vocabulary, was administered to children at the 3-and 4-year laboratory visits. For each item, children were asked to point to one of four drawings named by the examiner. A raw score was computed as the total number correct. These scores were highly stable across the two time points, r (261) = 0.73, p<0.01.

Work habits

The Instrumental Competence Scale: Short Form (ICS; Adler & Lange, 1997) assesses caregivers' perceptions of young children's ability to behave in an independent, self-directed, self-regulated, and motivated manner and is employed here as a measure of children's early work habits. Mothers rated how well nine items (e.g. likes to do challenging tasks; finishes tasks and activities) described their child on a 4-point scale during the 3-and 4-year laboratory visits. In prior research, maternal reports on this measure demonstrated good test–retest reliability over 6 weeks (r = 0.77), and scores predicted children's reading and math achievement in kindergarten (Howse, Calkins, Anastopoulos, Keane, & Shelton, 2003; Lange, MacKinnon, & Nida, 1989). A total score was calculated by summing items (Cronbach's α= 0.74 and 0.78 at 3 and 4 years, respectively). These scores were stable across the two time points, r (261) = 0.64, p<0.01.

Numeracy and language skills

The 54-month version of the Ages and Stages Questionnaire (ASQ, Bricker & Squires, 1999) was completed by mothers at the 4-year visit. Mothers indicated on a 3-point scale (not yet, sometimes, yes) whether their children display specific behaviours. Two six-item subscales particularly relevant to children's early school performance were used in the present study. The *communication* score reflects expressive and receptive language (e.g. follows 3 directions that are unrelated to one another; uses 4 and 5 word sentences; Cronbach's α = 0.68) and the *problem solving score* reflects early numeracy and language skills (e.g. names 5 different colours; counts up to 15; Cronbach's α= 0.50). The ASQ demonstrates good test–retest reliability over 2 weeks, inter-observer agreement between parents and examiners, and concurrent validity with administered developmental assessments (Squires, Potter, & Bricker, 1999).

To reduce the number of outcome variables, we conducted exploratory factor analyses of the 4-year PPVT, ICS, ASQ communication, and ASQ problem-solving scores. Results indicated one

factor with an eigenvalue above 1, with loadings ranging from 0.53 to 0.68 in the single factor solution. Therefore, a 4-year pre-academic skills composite was created by standardizing and averaging these scores. That this composite is multimethod, using both direct assessment and maternal reports of child skills, is a strength. Because the ASQ was not administered at the first wave, a 3-year pre-academic skills composite was formed by standardizing and averaging the PPVT and ICS scores, which correlated significantly with each other, r (261) = 0.28, p<0.01.

Descriptive statistics for the raw variables are presented in Table 1.

Table 1. Descriptive statistics for raw variables

	M	**S.D.**	**Min–Max**
Maternal cognitive support—task			
Metacognitive information	3.46	1.31	1.00–5.00
Cognitive information	3.45	0.65	1.00–5.00
Mental state language	0.53	0.56	0.00–3.35
Maternal emotional support—task			
Emotional responsiveness	3.78	0.95	1.00–5.00
Intrusiveness	3.12	1.03	1.00–5.00
Negativity	1.65	0.89	1.00–5.00
Home learning environment			
TAQ	23.08	2.26	11.00–26.00
TVRC	9.49	3.26	0.00–16.00
Maternal emotional responsiveness—general			
CCNES minimization	2.31	0.76	1.00–5.50

	M	S.D.	Min–Max
CCNES punitiveness	2.05	0.70	1.00–4.91
CCNES expressive encouragement	5.54	1.10	1.45–7.00
Pre-academic skills—3 years			
PPVT	42.13	16.58	4.00–83.00
Instrumental competence	3.02	0.31	2.28–3.72
Pre-academic skills—4 years			
PPVT	63.42	17.96	11.00–108.00
Instrumental competence	3.13	0.32	2.33–3.83
ASQ—communication	9.17	1.19	1.67–10.00
ASQ—problem solving	9.09	1.15	3.33–10.00

Note: TAQ, Toys and Activities Questionnaire; TVRC, Watching Television, Reading, and Computers at Home; CCNES, Coping with Children's Negative Emotions Scale; PPVT, Peabody Picture Vocabulary Test; ASQ, Ages and Stages Questionnaire. $N = 263$.

RESULTS

Preliminary Analyses

The proportion of missing data was small (3.6% overall); therefore, single imputation (Acock, 2005) using the NORM software (Schafer,1999), was employed. Next, we conducted a confirmatory factor analysis to ensure that maintaining four separate indicators of parenting was justified, as these types of parenting measures tend to be highly correlated. A four-factor model was fit to the data using Mplus 6.0 (Muthén & Muthén, 2006) and the Root Mean Square Error of Approximation (RMSEA; Steiger & Lind, 1980) and Comparative Fit Index (CFI; Bentler, 1990) were consulted to estimate the relative goodness of fit of the model. As a rule-of-thumb, RMSEA values smaller than 0.10 (Browne & Cudeck, 1993) and CFI values near 1.0 (Bentler, 1990) or smaller are considered favourable. The chi-square statistic was also computed. Results suggested adequate fit of the four-factor parenting model (χ^2 [38] = 50.69; RMSEA =

0.04; CFI = 0.98). Therefore, four parenting composites were created by standardizing and averaging scores as follows (standardized factor loadings from the confirmatory factor analyses are presented in parentheses following each indicator): *emotional support during the problem-solving task* consisting of emotional responsiveness (0.77), intrusiveness (reversed, 0.70), and negativity (reversed, 0.67); *cognitive support during the problem-solving task* consisting of cognitive information (0.59), metacognitive information (0.55), and mental state language (0.46); *home learning environment* consisting of the TVRC (0.82) and TAQ (0.59); and *general emotional responsiveness* consisting of expressive encouragement (0.25), punitive responses (reversed, 0.87)) and minimizing responses (reversed, 0.75).

Next we identified covariates by examining correlations between ethnicity (0 = white; 1 = non-white), socioeconomic status, and child sex (0 = female; 1 = male) and primary variables. Boys demonstrated lower academic skills than girls, r (261) = − 0.21, p<0.01. Minority and lower socioeconomic status mothers were rated as less cognitively and emotionally supportive during the problem-solving task and reported a less stimulating home environment and less emotional responsiveness than non-minority and higher socioeconomic status mothers; r (261) ranged from −0.14 to −0.44 and 0.22 to 0.41, respectively, all p<0.05. Pre-academic skills at 3 and 4 years were lower among minority and lower socioeconomic status children, r (261) = −0.24 and −0.19 for ethnicity and 0.36 and 0.42 for socioeconomic status, all p<0.01. Thus, ethnicity, socioeconomic status, and child gender were included as covariates in all analyses.

Substantive Analyses

The zero-order correlations between the study variables are shown in the first six rows of Table 2. Each of the four parenting measures correlated positively with children's pre-academic skills at both 3 and 4 years of age, and children's pre-academic skills were highly stable from 3 to 4 years of age. A series of partial correlations, displayed at the bottom of Table 2, were calculated to examine the extent to which each parenting measure correlated with pre-academic skills at the age of 4 years independent of demographics only (gender, ethnicity, and SES), pre-academic skills at age 3 only, and then both demographics and pre-academic skills at age 3. Maternal emotional support and the home learning environment remained significant correlates of pre-academic skills in every variation of partialling, lending support for the first hypothesis in that when considered in isolation of the other parenting dimensions, emotional support during the problem-solving task and the home learning environment were correlated with gains in academic achievement and this remained true even when demographics were controlled. In contrast, cognitive support during the task was no longer a significant correlate of pre-academic skills at age 4 when earlier pre-academic skills were controlled, and emotional responsiveness was no longer a significant correlate of pre-academic skills at age 4 when any of controls were entered.

Table 2. Correlations among the major study variables

	1	2	3	4	5
1. Maternal Cognitive Support-Task	—				
2. Maternal Emotional Support-Task	0.53**	—			
3. Home Learning Environment	0.34**	0.32**	—		
4. Maternal Emotional Responsiveness	0.25**	0.26**	0.24**	—	
5. Pre-Academic Skills-3 years	0.34**	0.34**	0.38**	0.20**	—
6. Pre-Academic Skills-4 years	0.31**	0.40**	0.43**	0.21**	0.74**
Controlling for demographics	0.13*	0.23**	0.29**	0.11	
Controlling for 3Y Pre-Academic Skills	0.09	0.23**	0.24**	0.09	
Controlling for demographics and 3Y Skills	0.01	0.16**	0.17**	0.05	

N = 263.
* *p⩽0.05.
** **p⩽0.01.

A hierarchical multiple regression analysis was conducted to test the contribution of each type of parenting to pre-academic skills independent of one another and to test the hypothesis that emotional and cognitive support during the problem-solving task would be particularly strong predictors of increased pre-academic skills at 4 years among children whose initial pre-academic skills were low. As all predictor variables were composites of standardized variables, centering was not necessary prior to entering the predictors in the regressions. In the first step of the regression analysis, child gender, ethnicity, socioeconomic status, and child pre-academic skills at 3 years were entered. The second step included maternal cognitive support and emotional support during the problem-solving task, the home learning environment, and general maternal emotional responsiveness at age 3. The third step included interaction terms calculated as the product of each parenting variable and children's pre-academic skills at age 3. Interactions with the home learning environment and general emotional responsiveness were included to ensure that any interaction effect between maternal behaviour during the task and pre-academic skills at age 3 was not merely a function of the more general parenting dimensions. Significant

interactions were probed by calculating and plotting simple slopes at 1 S.D. above and below the mean of pre-academic skills at age 3, following procedures outlined by Aiken and West (1991). Results are presented in Table 3.

Table 3. Hierarchical regression analyses predicting pre-academic skills at age 4

	B	**S.E.**	**β**	**ΔR^2**	***F*Δ**
Step 1: df = 4, 258				0.58	87.95**
Child gender[a]	−0.11	0.06	−0.08		
Mother's ethnicity[a]	0.02	0.06	0.01		
Socio-economic status	0.16	0.04	0.19**		
3-year pre-academic skills	0.60	0.04	0.66**		
Step 2: df = 8, 254				0.02	3.87**
Maternal cognitive support—task	−0.05	0.05	−0.05		
Maternal emotional support—task	0.12	0.04	0.13**		
Home learning environment	0.11	0.04	0.13**		
Maternal emotional responsiveness	0.01	0.04	0.01		
Step 3: df = 12, 250				0.02	2.90*
Cognitive support × 3-year pre-academic skills	0.05	0.06	0.04		
Emotional support × 3-year pre-academic skills	−0.15	0.05	−0.15**		
Home Learn Env × 3-year pre-academic skills	−0.03	0.05	−0.02		
Emotional Respon × 3-year pre-academic skills	−0.03	0.05	−0.03		

* *p⩽0.05.

** **p⩽0.01.

a [a]Child gender and mother's ethnicity dummy coded: 0 = female, 1 = male; 0 = White, 1 = non-White.

The first step of the regression indicates that children's academic skills were highly stable from age 3 to age 4 even when covariates were considered. In the second step of the regression, after controlling for demographics and pre-academic skills at age 3, maternal emotional support during the problem-solving task and the home learning environment were significant independent predictors, whereas cognitive support during the task and general emotional responsiveness were not. Thus, consistent with prediction, mothers who provided more emotional support to their children during a problem-solving task at 3 years had children with greater gains in pre-academic skills at 4 years, and this effect was independent of the significant positive effect of a stimulating home environment. As demonstrated in step 3, only the interaction effect between emotional support in the problem-solving task and pre-academic skills at age 3 was significant. Consistent with prediction, and as illustrated in Figure 1, maternal emotional support during the task was positively associated with 4-year pre-academic skills among children who had lower pre-academic skills at 3 years (b = 0.22, p<0.01), but not among children with higher pre-academic skills at 3 years (b = − 0.02, ns). The parental support main effects and interactions accounted for an additional 4% of the variability in children's pre-academic skills after accounting for stability over time and demographic characteristics.

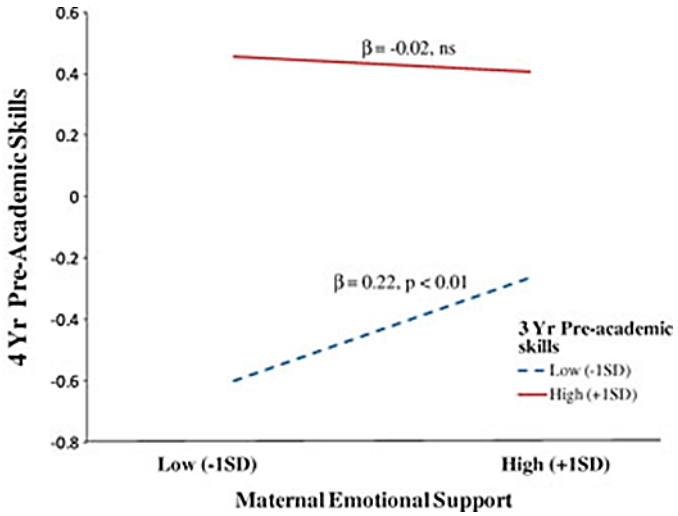

Figure 1. Moderating effect of pre-academic skills at age 3 on the association between maternal emotional support at age 3 and pre-academic skills at age 4.

In *post hoc* analyses, we examined the extent to which the pattern of results for the total pre-academic skills composite was replicated when each index of pre-academic skills was examined

separately. Consistent with the results reported in Table 3, cognitive support during the problem solving task and general emotional responsiveness were unrelated to each index of pre-academic skills independent of controls and the other parenting behaviours. The effects of emotional support during the problem-solving task and the home learning environment were consistent in valence, but varied in magnitude across the various indices of pre-academic skills. The positive main effect of emotional support during the problem-solving task was strongest in relation to the PPVT ($\beta = 0.15$), the positive effect of the home learning environment was strongest in relation to mothers' reports of communication ($\beta = 0.14$) and problem solving ($\beta = 0.15$) on the ASQ, and the interaction between pre-academic skills at age 3 and emotional support was strongest in relation to mothers' reports of problem solving (reflecting letter and numeracy skills) on the ASQ ($\beta = -0.25$).

DISCUSSION

Maternal emotional support and cognitive support during a joint problem-solving task, the quality of the home learning environment, and mothers' general emotional responsiveness when children were 3 years old were positively correlated with children's pre-academic skills 1 year later. However, when examined simultaneously and controlling for children's prior pre-academic skills and demographics, only maternal emotional support during the problem-solving task and the quality of the home learning environment were associated with gains in pre-academic skills at age 4. Importantly, the effect of maternal emotional support during a problem-solving task on children's subsequent skills was qualified by an interaction with children's earlier pre-academic skills such that children who were at greater academic risk at age 3 benefitted more from maternal emotional support than other children. The effect size for the links between supportive parenting at age 3 and pre-academic skills at age 4 was small. However, that these effects were significant given the conservative approach of controlling for prior pre-academic skills is notable. Moreover, given that academic skills are highly stable over time in this and other samples (e.g. Hubbs-Tait *et al.*, 2002; NICHD Early Child Care Research Network, 2008), identifying factors that contribute to even a small positive change in such skills is of practical importance because early academic skills are linked to subsequent school adjustment—both academically and socially—which has implications for children's long-term adjustment.

The positive effect of maternal emotional support during problem solving on gains in children's early pre-academic skills independent of other parenting dimensions is consistent with prior research. For example, emotional support (i.e. positive feedback) during problem solving was linked with higher perceptual skills in kindergarten independent of cognitive support and general emotional support (Hubbs-Tait *et al.*, 2002) and the affective quality of maternal behaviour during book reading was more predictive of children's emergent reading than was the quality of mothers' direct reading instruction (Bingham, 2007). Moreover, ours is the second study to demonstrate that the positive effect of maternal emotional support during a problem-solving task on children's pre-academic skills is not just a function of the general emotional quality of the mother–child relationship, as the effect was independent of a more global measure of emotional

responsiveness. Rather, attending to young children's emotional needs during problem solving is uniquely and critically important to their early academic skill development, consistent with a Vygotskian perspective (Barocas *et al.*, 1991). Based on prior research, we suspect that the positive link between emotional support during problem solving and children's subsequent academic skills is mediated by children's enhanced attentional, emotional, and behavioural control and motivation (NICHD Early Child Care Research Network, 2003,2008). That is, mothers' interest, encouragement, and praise during challenging problem-solving tasks likely helps young children to remain focused and calm in the moment, thereby enhancing learning and performance. Further, mothers' emotional support during difficult tasks teaches children control strategies that they can apply independently in future settings, instills confidence in their own abilities, and conveys that learning is important and valued, all of which promote the acquisition of pre-academic skills.

Our interpretation of the interactive effect between maternal emotional support and children's prior pre-academic skills is consistent with this view. That is, children with lower initial levels of pre-academic skills may be more easily frustrated by the demands of cognitively oriented tasks, more prone to giving up easily, or less able to focus attention on a difficult task, thereby making them particularly likely to benefit from maternal emotional support as described above. This moderating effect and similar findings in other studies of young children (Gaertner *et al.*, 2008; Smith *et al.*, 2000) suggest that children who are at greatest early academic risk benefit most from emotionally supportive parenting during challenging tasks.

In contrast, a high-quality home learning environment characterized by the presence of books, stimulating materials, and efforts to engage the child in enriching activities was linked with gains in pre-academic skills for children independent of the other parenting dimensions regardless of children's prior skills. This finding is consistent with a host of prior evidence linking the quality of the home learning and literacy environment to children's early academic competence (Bradley, 2002). That this effect was independent of all of the other parenting dimensions underscores the salience of a high-quality home environment for early academic readiness.

That maternal cognitive support during problem solving was not independently related to gains in children's pre-academic skills in this sample does not dismiss its importance. First, maternal emotional support and cognitive support during the game were both positively correlated with pre-academic skills at the age of 3 and 4 years, and the coefficients were of comparable magnitude at age 3. Additionally, prior research that has utilized parenting composites suggests that cognitive support is part of a constellation of parenting behaviours that is likely necessary to promote optimal child performance in school (NICHD Early Child Care Research Network, 2003, 2008). Moreover, measures of cognitive support based on finer coding of the complexity of maternal statements and questions during problem solving have predicted subsequent academic skills of a perceptual nature albeit not of a verbal nature (Hubbs-Tait *et al.*, 2002). Thus, the independent links between maternal cognitive support and early academic skills may vary depending on the type of academic skill under consideration. Examining the

links between parenting dimensions and verbal versus non-verbal academic skills was not a viable option in this study, as all non-verbal skill measures at age 4 were based solely on maternal report.

The results of the current study may have implications for individuals working with children at risk for early academic problems. If parents and others are concerned about a child's academic readiness, they may focus their primary efforts on creating learning tasks for the child. When coupled with the pressures of standards and accountability, there may be a tendency to inadvertently de-emphasize children's emotional needs in these contexts. Moreover, such tasks may be particularly challenging for children who do not readily acquire pre-academic skills. Our results indicate that parents should be encouraged to make learning and problem-solving tasks pleasant, to praise their children for their efforts and accomplishments, and to avoid becoming frustrated with and critical of their young children during such interactions.

There are four notable limitations of the current study. First, the absence of father data is a limitation because fathers' cognitive and emotional support may demonstrate a different pattern of association with young children's academic readiness than mothers' (NICHD Early Child Care Research Network, 2003, 2008). Second, although our measure of cognitive support during the task incorporated mothers' use of mental state language, we did not code the extent to which mothers used statements that were likely to push their child's understanding to a higher level (Hubbs-Tait *et al.*, 2002). In contrast, our observational measure of emotional support during the task was more comprehensive than that used in other studies in that we focused on a number of elements including praise, positive ways of maintaining the child's interest and enthusiasm for the task, and the absence of intrusiveness and negativity. This may account for the stronger and independent role of emotional support relative to cognitive support in relation to pre-academic skills. Third, the measures of the home learning environment and emotional responsiveness were based solely on maternal reports. To best determine if emotional and cognitive support during problem-solving tasks are more predictive of early academic skills than more general measures of emotional responsiveness and cognitive stimulation, greater care must be taken to ensure that measures of each parenting construct are equally strong; a multimethod approach incorporating behavioural observation and parent-reported indicators of each would be ideal. Finally, and most importantly, the current pre-academic skills composite, with the exception of vocabulary, was based on maternal reports, and the measures were not identical across time as the ASQ was administered at age 4 but not at age 3. The use of additional objective assessments or multiple informants that are comparable over time is needed in future research as is greater attention to specific dimensions of academic readiness (i.e. verbal versus non-verbal; Hubbs-Tait *et al.*, 2002). For these reasons, replication and extension is needed in other samples.

Despite these limitations, the results of this study demonstrate the importance of considering various dimensions of parenting separately, rather than collapsing them, a point recently made by other parenting researchers (e.g. Bradley, 2002; Grusec & Davidov, 2010; Leerkes, Blankson, & O'Brien, 2009). Such an approach has the potential to generate findings that can be more readily

translated into approaches to intervention and recommendations to parents. By identifying the parenting dimensions that are most predictive of pre-academic skills for different kinds of children, parents and teachers could be given information that would allow them to provide the kinds of support that are most effective for particular children and families. Such efforts are particularly warranted given the pressures that young children, their parents, and educators face in relation to preparing for entry into formal schooling.

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