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Family and child influences on early academic and emotion regulatory behaviors

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Abstract

Research on child and family factors in early childhood has shown that both are associated with social and instrumental functioning at school entry. The present study sought to examine the direct and indirect effects of child negative emotionality, maternal education, depression, IQ, and quality of maternal instruction on children's academic and emotion regulatory behaviors from the toddler period to school entry using a sample of 174 boys from low-SES backgrounds. Results revealed direct effects of maternal IQ on academic outcomes at school entry that were mediated by maternal instruction. Further, maternal instruction predicted the child's academic and emotion regulation (ER) outcomes even after accounting for other maternal and child variables. The effects of both instruction variables moderated the impact of maternal education. The results suggest that maternal instruction plays an important role in early school success, particularly for children at risk for school problems. © 2004 Society for the Study of School Psychology. Published by Elsevier Ltd. All rights reserved.

Keywords: Parenting; Emotion regulation; Academic achievement

Introduction

At school, entry children are confronted with the challenge of adapting their developing academic (Alexander & Entwisle, 1988) and social (Calkins, 1994) behavior patterns to suit a school environment. Unfortunately, some children fail to meet this challenge, which can have a long-lasting negative impact on their success in the school context (Alexander

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& Entwisle, 1988; Arnold et al., 1999; Cowan, Cowan, Schulz, & Heming, 1994). Research has consistently demonstrated that children, who by the age of eight, are unable to adjust and function well in school have difficulty in their future adjustment (Alexander & Entwisle, 1988). Therefore, it is important to identify and understand factors that may influence a children's ability to function well during the early school years.

Family risk factors, such as poverty and family dysfunction, have been shown to place young children at higher risk for academic and social maladjustment (Brooks-Gunn & Duncan, 1997; Dodge, Pettit, & Bates, 1994). Several theoretical models have been proposed to describe how family and child factors may influence children's school success (e.g., Hess & Holloway, 1984; Ladd, Birch, & Buhs, 1999; Sameroff & Chandler, 1975). Research has focused on both parental involvement as a facilitator of children's learning (Alexander & Entwisle, 1988; Hess & Holloway, 1984), and the interaction between caregiving and child characteristics to predict both academic and emotion regulation outcomes (Denham, 1993; Ladd et al., 1999). The current study adopts the "child \times environment" model (Ladd et al., 1999), similar to the transactional model (Sameroff & Chandler, 1975), to focus on how children respond to the challenge of school entry. The model considers both personal factors, such as a child's negative emotionality, and interpersonal experiences gained in the early childhood years, such as the child's relationship with caregivers, that provide skills for successful adjustment to school (Ladd, 1989).

The present study aims to extend previous research by examining both direct and interactive effects of child negative emotionality and caregiving factors on children's academic and emotion regulation (ER) behaviors at school entry in a sample of high-risk boys. Academic behaviors are defined as those related to children's success in school, such as ignoring distractions, attending to instructions, keeping organized. Emotion regulation behaviors are defined as skills children need to forge successful relationships with both teachers and peers, including controlling one's temper, responding appropriately to teasing, and displaying appropriate emotional expression. Initially the study will attempt to examine the direct effect of variables found to predict a children's academic and emotion regulatory functioning (e.g., child negative emotionality and maternal depression). Secondly, the study will examine whether maternal instruction mediates the direct impact of the above variables on both social and instrumental functioning. Finally, the study will test whether maternal instruction moderates the effects of child negative emotionality and caregiving factors on a child's later academic and emotion regulatory outcomes.

"Child \times environment" model

The "child \times environment" model proposes that individual differences in a child's outcomes, particularly at transition points such as the child's entrance into formal schooling, should be understood as a by-product of a child's attributes (e.g., negative emotionality), environmental factors (e.g., the caregiving environment), and the interaction that exists between the two (Coie et al., 1993; Connell & Wellborn, 1991; Garnezy, Masten, & Tellegen, 1984; Ladd, 1989, 1996). The model assumes that child and environmental factors can have both direct and interactive effects on a child's adjustment

in school (Ladd & Tropp-Gordon, 2003). Independently, such child attributes as negative emotionality could hinder efforts to stay on task or get along with peers in the classroom setting. However, the impact of negative emotionality could also be exacerbated or lessened by characteristics of the caregiving environment, such as maternal sensitivity (Bell, 1986; Sameroff & Chandler, 1975; Thomas, Chess, & Birch, 1968).

Child characteristics

Prior research has documented a direct link between a child's negative emotionality and academic outcomes. For example, Newman, Noel, Chen, and Matsopoulos (1998) found a negative relationship between children's negative emotionality at kindergarten and reading skills in the first grade. Teachers have been found to rate children who are easily frustrated or have a quick temper as less "teachable" and more prone to behavior problems that disrupt the classroom (Martin, 1994). Using the present data set, Gilliom, Shaw, Beck, Schonberg, and Lukon (2002) found that the level of anger expressed by preschool-age children during a frustration task at age 3.5 was related to teachers' reports of behavior problems at school entry.

In addition to demonstrating that child attributes are directly related to later socioemotional outcomes, several investigators have documented that the relation between such child attributes as negative emotionality on child outcomes is moderated by the quality of caregiving practices (Bates, Pettit, Dodge, & Ridge, 1998; Martin, 1981; Shaw, Keenan, & Vondra, 1994; Shaw et al., 1998). For example, Martin (1981) found that the relation between infant negative emotionality and child disruptive behavior at preschool was moderated by the level of maternal responsiveness, a finding that has been twice replicated by Shaw et al. (1994, 1998) using the same high-chair task. It appears that caregivers who are able to lessen the intensity of children's negative emotions may moderate the association between negative emotionality and child adjustment in a positive manner (Gilliom et al., 2002; Milliones, 1978; Rubin, Nelson, Hastings, & Asendorpf, 1999). Conversely, maladaptive child outcomes associated with negative emotionality may be exacerbated in the context of specific caregiving practices (Bates et al., 1998; Martin, 1981; Shaw et al., 1994, 1998).

Quality of the caregiving environment

The caregiving environment may influence the course of child adjustment directly via parenting effects, and indirectly via factors that compromise the quality of caregiving, such as maternal depression, education, IQ and instruction.

Maternal depression

Research has demonstrated an association between maternal depression and both the quality of parenting and children's cognitive and social outcomes, suggesting the potential for both indirect and direct relations between depression and child functioning, respectively. Children of depressed versus nondepressed mothers have been found to exhibit poorer academic performance and achievement (Greenberg, Coie, Lengua, & Pinder-

hughes, 1999; Lyons-Ruth, Connell, Grunebaum, & Botein, 1990; Murray, 1992; Murray, Fiori-Cowley, Hooper, & Cooper, 1996). Similar relationships have been found between maternal depression and children's social competence (Field, 1995; Stein et al., 1991) and behavioral problems (Murray, 1992).

Indirect pathways between maternal depression and child outcomes have also been explored via parenting. However, most of these studies have investigated the impact of maternal depression on global parenting skills (Goldsmith & Rogoff, 1995) rather than examining specific links with maternal instruction.

Maternal education

Overall, level of maternal education has been associated with pervasive and chronic effects on children's adjustment, with more educated parents showing more adept instruction strategies, styles, and techniques (Borduin & Henggler, 1981; Neitzel & Dopkins Stright, in press). Mothers with more formal schooling have greater exposure to multiple learning strategies and styles (Flavell, 1979; Kuhn & Angelev, 1976) and more practice with diverse problem-solving tasks. Mothers with more education have been found to provide more effective problem-solving strategies for their children and to use fewer direct control tactics (Borduin & Henggler, 1981). Further, maternal education has been found to attenuate the relationship between children's negative emotionality and parental teaching quality (e.g., provision of strategies, active task engagement) (Neitzel & Dopkins Stright, in press).

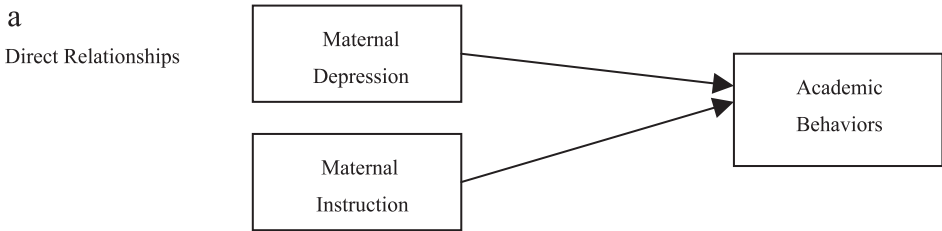
Maternal IQ

Research on the impacts of maternal IQ has shown both direct and indirect relations to children's outcomes. Higher maternal IQ scores have been found to have a direct relationship to children's later cognitive outcomes (Bacharach & Baumeister, 1998; Boddy, Skuse, & Andrews, 2000; Burchinal, Campbell, Bryant, Wasik, & Ramey, 1997) as well as an indirect relationship that is mediated by the quality of the parenting (Bacharach & Baumeister, 1998; Burchinal et al., 1997). In addition, some studies have found higher maternal IQ to be related to more positive parenting practices (Bacharach & Baumeister, 1998; Watson, Kirby, Kelleher, & Bradely, 1996; Bradley et al., 1993; Whiteside-Mansell, Pope, & Bradely, 1996).

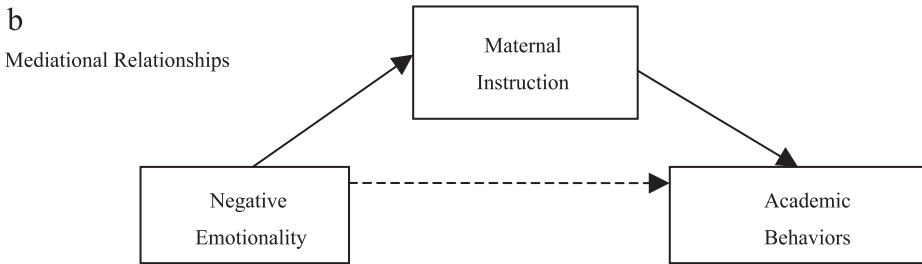
Maternal instruction

Mothers are generally children's primary instructors prior to school entry, and therefore, maternal instruction has been hypothesized to be influential in children's cognitive development. Maternal instruction has been conceptualized as either an overall construct (e.g., Pianta & Harbers, 1996) or as a series of unique components such as emotional support, strategy instruction, and others (e.g., Dopkins Stright & Neitzel, 2003). Research examining the individual components has found differing relationships. For example, maternal emotional support predicts a child's help seeking behavior, whereas maternal active cognitive engagement predicts a child's behavioral control (Dopkins Stright, Neitzel, Garza Sears, & Hoke-Sinex, 2001). Therefore, the current study examines individual components of maternal instruction to determine their effects on child outcomes.

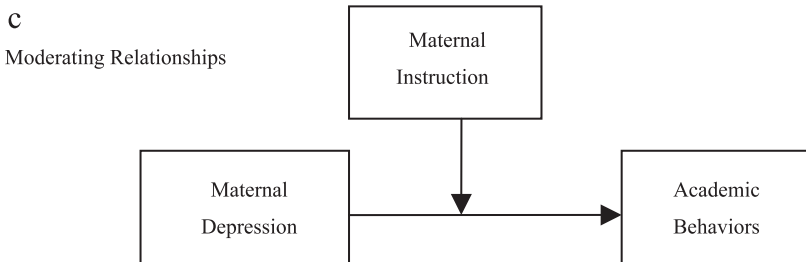
Based on the work of Rogoff (1990), this paper focuses on four components of maternal instruction that have been found to relate to children’s academic (e.g., Dopkins Stright et al., 2001; Grolnick & Ryan, 1989; Pianta, Smith, & Reeve, 1991) and social outcomes (Cowan et al., 1994; Morrison, Rimm-Kaufman, & Pianta, 2003). These components include: the degree to which a mother prepares her child for a task by describing its different elements and their relation to the final goal; the number and quality of strategies that a mother provides; the extent to which mothers involve children in the decision-making process; and a mother’s emotional support during problem solving. The first three components demonstrate how a mother facilitates her child’s acquisition of



Maternal depression and maternal instruction directly effect academic behaviors



Maternal instruction mediates the effects of negative emotionality on academic behaviors



Maternal instruction moderates the effect of maternal depression on academic behavior

Indirect ----- Direct _____

Fig. 1. Theoretical model of direct and indirect effects of a child’s negative emotionality on academic and emotion regulation.

effective problem-solving skills (Rogoff, 1990). The emotional support component relates to mothers' developing their children's confidence in using their problem-solving skills (Ginsburg & Bronstein, 1993).

Overall, research suggests that maternal instruction may be directly related to both children's academic and social adjustment, and in some cases, mediate the impact of other family factors (e.g., maternal depression, maternal education, maternal IQ, and children's negative emotionality) on school achievement. However, there is a lack of research examining how such instructional strategies may moderate the relation children's characteristics (e.g., negative emotionality) and later school outcomes.

The present study aims to extend previous research by investigating the relationship between components of maternal instruction and both academic and ER outcomes. Specifically, the current study will examine both the direct and indirect effects of children's negative emotionality, maternal depressive symptoms, maternal education, maternal IQ, and maternal instruction on children's later school outcomes. An example of some of the hypothesized relationships in this study can be found in Fig. 1. This diagram shows an example of a hypothesized direct relationship (Fig. 1a) and two examples of hypothesized indirect links (Fig. 1b and c) between maternal and child factors and school outcomes, including direct, mediational, and interactive paths. In addition to direct relationships found in prior research (see Fig. 1a), it is expected that maternal instruction will mediate the impact of maternal education and depression and children's negative emotionality on children's early school outcomes (see Fig. 1b). It is also hypothesized that maternal instruction will moderate the effects of other maternal and child variables, specifically maternal education, IQ, and depression and children's negative emotionality (see Fig. 1c).

Methods

Participants

The sample used in the present study was derived from a larger study examining the antecedents of early conduct problems in boys (see Shaw, Winslow, & Flanagan, 1999 for more information about the sample). Participants for the study were recruited when the children were between 6 and 17 months of age from Women, Infants and Children and Nutritional Supplement (WIC) Clinics, which serve income-eligible families with young children. At the time of recruitment, the mothers ranged in age from 17 to 43 years of age with a mean income of \$12,552 ($SD=7680$) per year. Of the 421 families who were approached and agreed to participate, 310 (74%) participated in the initial 18-month-old assessment and 282 (67%) participated in the 42-month-old assessment. One hundred and seventy-four of these families (41%) had school records available at age six and/or seven. Of those children who had school data, an average of five children missed each assessment. None of the children missed more than one assessment. The majority of the families were Caucasian (54%) and African American (40%) while the remaining 6% were other (Hispanic, Asian, or bi-racial). At the 18-month visit, 64% of mothers stated they were married or living with a partner, 8% were divorced, 28% stated they were

always single, and 1% were other (e.g., widowed, separated). The children with school data at ages 6 and 7 did not differ significantly from the participating boys without school data on maternal education ($F(1, 309)=1.58, ns$), maternal depressive symptoms ($F(1, 278)=.32, ns$), family income ($F(1, 305)=2.95, ns$) or child negative emotionality ($F(1, 296)=.05, ns$).

Procedures

Mothers and sons completed a series of laboratory-based assessments when children were 18, 24, and 42 months old. Maternal education and depressive symptomatology were collected using questionnaires at all three time points. Mothers reported on the children's negative emotionality at the 18- and 24-month assessments, and engaged with children in a series of cooperative tasks during the 42-month visit.

During the 18-month assessment, mothers completed questionnaires and mothers and sons completed a series of interaction tasks. All tasks were videotaped from behind a one-way mirror and coded at a later point in time. The visit began with a 15-min free play which was followed by a 5-min clean up task. Next the child had no toys for 5 min and then the mother and child worked on three cooperative tasks for three minutes apiece. This was followed with a break, and then the Strange Situation (Ainsworth, Blehar, Waters, & Wall, 1978). Each of the lab assessments was approximately 2 to 2.5 h in duration and mothers were reimbursed for their participation. The 24- and 42-month assessments were altered slightly to account for developmental appropriateness but maintained a similar overall structure. The 24-month assessment was preceded by a 1-h home visit.

Mother-child interactions were coded using one of three cooperative tasks administered at the 42-month assessment. A building task was chosen because the difficulty level was just above what the child should have been able to complete independently; therefore, it provided the best opportunity to observe maternal instruction. Mothers were presented with waffle-shaped building blocks and told to work with their children to build a barn.

When the children were 6 and/or 7 years old, their classroom teachers were sent a packet of questionnaires, including the Teacher Report Form (TRF; Achenbach, 1991) and Social Skills Rating Scale (SSRS; Gresham & Elliott, 1990), to complete for the participating children. The teachers were reimbursed for their participation. Teachers completed and returned questionnaires on 174 children.

Measures

Maternal depressive symptoms

Maternal depressive symptoms were assessed at 18-, 24- and 42-months using the Beck Depression Inventory (BDI). The BDI is a widely used measure of depressive symptomatology for which split-half reliability has been found to be high (.86 to .93) (Beck, Steer, & Garbin, 1988). To make the inventory more trait-like, directions for the BDI were altered such that mothers were instructed to report about depressive symptoms experienced in the past 6 months rather than the past week. Due to the findings that chronic rather than episodic periods of depression are more detrimental to children's adjustment (Lyons-Ruth, Connell, Zoll, & Stahl, 1987), a composite of the three ratings of maternal depressive

symptoms (all ratings correlated .60 or higher between assessments) was created averaging reports from the 18-, 24-, and 42-month assessments (see Table 1).

Child negative emotionality

Child negative emotionality was assessed using mothers' reports at the 18- and 24-month assessments based on the 22-month version of the Difficulty factor of the Bates' Infant Characteristics Questionnaire (ICQ; Bates, Freeland, & Lounsbury, 1979). The Difficulty factor assesses the intensity and frequency of fussy, irritable children's behavior. The ICQ has shown to be predictive of preschool behavior problems (Bates, Maslin, & Frankel, 1985). Internal consistency of the difficulty factor for the 18-month ($\alpha=.81$) and 24-month assessment ($\alpha=.80$) was good and stability was moderate from 18 to 24 months ($r=.63$, $p<.01$). To generate a composite score from the 18- and 24-month Difficulty factor, the items were summed and then averaged.

Maternal education

Mothers were asked to report their highest level of education at all visits. The maternal education variable represents a composite of the average levels of education reported at the 18-, 24-, and 42-month visits (see Table 1).

Maternal intelligence

To account for the influence of maternal IQ in relation to the effects of other independent variables on children's school functioning, the Information (I) and Picture Completion (PC) subscales of the Weschesler Adult Intelligence Scale-Revised (WAIS) were administered at the 24-month assessment. The WAIS-R is a widely accepted measure of adult intelligence quotients. The I and PC subscales have been used commonly as a short form of the WAIS-R because of their high correlation with the total WAIS-R score (.88) (Kaufman, 1990). The average reliability for these subtests for adults is .90–.93 (Kaufman, 1990).

Maternal instruction

Maternal instruction was rated using observations of parent–child interaction during the waffle barn task at the 42-month assessment. The codes were adapted from a system

Table 1
Descriptive statistics for measures

	Mean	Standard deviation	Range
Negative emotionality	23.12	5.75	10.50–42.50
Maternal depression	7.94	5.74	.33–33.00
Maternal education	12.45	1.75	7.33–18
Maternal intelligence	85.27	12.01	59–123
Maternal instruction: advanced organizers	2.80	.83	1–5
Maternal instruction: strategy instruction	2.96	1.03	1–5
Maternal instruction: active cognitive engagement	2.66	1.28	1–5
Maternal instruction: encouragement	2.46	1.24	1–5
Academic behaviors	-.00	.68	-1.6–.9
ER behaviors	.01	.60	-2.3–1.4

(Dopkins Stright et al., 2001) based upon the work of Rogoff (1990). All ratings were based on a five-point scale (1 = low; 5 = high). The advanced organizer code was used to rate how well the mother introduced the child to the task, provided initial set-up instructions (e.g., “We are going to be building a barn,” “We should get all the pieces out and organize them so all the ones that look alike are together.”). Strategy instruction was rated based on the frequency and quality of the problem-solving strategies provided to the child. This would include indirect instruction, such as the mother drawing attention to her use of strategy, and direct instruction (e.g., “Look at the picture to see where that piece fits on the barn.”). Active cognitive involvement was rated according to the frequency and quality of the mother’s attempts to involve the child in the task rather than doing the task for the child (e.g., “Where do you think this piece goes?” “How many more pieces do we need to finish the fence?”). Mothers who were low in active engagement would tell children exactly how to complete the task (or do the task for children). Finally, mothers were rated on the frequency and quality of their encouraging statements to children. This code included simple motivating statements (e.g., “Good job!” “I think you can do it!”) and instances in which mothers made the task fun for children. Inter-rater reliability for the maternal instruction variables was calculated based on 22% of the tapes and was found acceptable (Pearson *r* between .77 and .96; weighted Kappa between .66 and .91). Coders were blind to all other maternal and child variables.

Table 2
Factor loadings for items for academic and emotion regulation behaviors

Items	Academic	ER
Finishes class assignments within time limits	.77	
Produces correct schoolwork	.76	
Puts work materials or school property away	.67	
Ignores peer distractions when doing class work	.72	
Keeps desk clean and neat without being reminded	.63	
Attends to your instructions	.78	
Has difficulty learning	.83	
Poor school work	.79	
Messy work	.77	
Underachieving, not working up to potential	.83	
Fails to carry out assigned tasks	.72	
Controls temper in conflict situations with peers		.71
Compromises in conflict situations by changing own ideas to reach agreement		.58
Responds appropriate to teasing by peers		.66
Controls temper in conflict situations		.78
Responds appropriately when pushed or hit by other children		.73
Cries a lot		.47
Nervous, high-strung or tense		.61
Too fearful or anxious		.39
Screams a lot		.71
Explosive or unpredictable behavior		.80
Demands that must be met immediately, easily frustrated		.79
Sudden changes in mood or feeling		.77
Temper tantrums or hot temper		.81

Total Eigenvalue for the first factor: academic = 6.29, ER = 8.36.

Academic and emotion regulatory behaviors

Classroom teachers were asked to complete the TRF and SSRS when children were 6 and/or 7 years old. The Teacher Report Form is a widely used measure of child problem behavior rated on a 0 (not true) to 2 (very true) scale. The TRF has adequate test–retest reliability (Achenbach, 1991). The SSRS assesses children’s social skills, behaviors and academic competence on a scale of 0 (never) to 2 (very often). The SSRS has good criterion validity with the TRF for all three subscales (social skills = $-.64$, problem behavior = $.81$, and academic competence = $-.59$) (Gresham & Elliott, 1990).

Factors of academic and emotion regulatory functioning were generated from appropriate items from the TRF and SSRS to create more robust and generalizable constructs. For the academic skills factor, items were selected from both the SSRS and TRF based on their relevance to appropriate classroom behavior. A list of these 13 items is provided in Table 2, with factor loadings for each item (total $\alpha = .92$). Examples include, “Ignores peer distractions when doing class work.” and “Messy work.” Using a similar method, a 13-item factor of ER was generated from the TRF and SSRS (see Table 2; total $\alpha = .89$). Examples of items include, “Controls temper in conflict situations.” “Demands that must be met immediately, easily frustrated.” The items on the TRF were reverse scored so that higher scores indicated more positive behavior for all items.

Results

Initially, descriptive statistics and bivariate correlations among the variables included in this study will be presented. Next, the maternal and child variables will be tested for mediating influences on child outcomes. Finally, both direct maternal and child influences as well as interactions between them will be tested for moderating influences on child outcomes.

Descriptive statistics for study variables

The means, standard deviations and ranges of study variables can be found in Table 1. The average scores for depressive symptoms on the Beck Inventory bordered on being in the “mild depression” range (score of 9 is considered mild depression, Beck et al., 1988) at the 18-month assessment. There was a decline in depressive symptoms over the period between the 18- ($x = 8.76$, $SD = 6.50$) to 42-month assessment ($x = 7.02$, $SD = 6.54$), consistent with other research showing that the initial years of childrearing can be more stressful for mothers, with improvements as the child moves into the preschool period (e.g., Lyons-Ruth, Wolfe, Lyubchik, & Steingard, 2002). The mothers in this study had a mean of 12 years of education and a slightly below average IQ. This finding is not surprising given that the sample was drawn from a lower socioeconomic status population selected initially on income criterion. This sample signals a departure in the field, as the majority of similar studies have used well-educated, middle-class samples (e.g., Dopkins Stright et al., 2001).

Prior to computing direct relations among other study variables, we investigated the possibility that ethnicity may be related to children’s school adjustment based on the

findings of prior research on minority children's school achievement (Alexander & Entwisle, 1988). Correlations indicated that maternal ethnicity, dichotomously coded as either European American or African American (AA), was significantly related to both academic ($r = -.21, p < .01$) and ER outcomes ($r = -.26, p < .01$), with AA children showing poorer adjustment in both cases. However, in later analyses when IQ and education were entered prior to ethnic status in a regression examining relations with academic and ER outcomes, ethnicity was no longer significantly related to either measure. Thus, ethnicity was not used in subsequent analyses.

Relations between maternal IQ, maternal depression, maternal education, maternal instruction, child negative emotionality and early school outcomes

To examine associations between maternal and child risk factors and school outcomes, a series of bivariate correlations was computed (see Table 3). Results indicated that maternal IQ was significantly, albeit modestly, correlated with children's academic behaviors ($r = .17, p < .05$). Regarding maternal instruction and its relation to children's outcomes, the amount of strategy instruction the mother provided was positively correlated with both children's academic ($r = .21, p < .01$) and emotion regulatory behaviors ($r = .22, p < .01$). In addition, the mother's active cognitive engagement was positively correlated with children's academic ($r = .19, p < .01$) and emotion regulatory ($r = .20, p < .01$) behaviors.

Correlations were also computed to examine the relations between maternal and child variables and maternal instruction at 42 months. Maternal IQ was positively correlated with the amount of advanced organization provided ($r = .21, p < .01$), strategy instruction ($r = .30, p < .01$), active cognitive engagement ($r = .24, p < .01$), and encouragement ($r = .25, p < .01$). Maternal education was also positively correlated with the amount of advanced organization ($r = .17, p < .05$), strategy instruction ($r = .14, p < .05$) and active cognitive engagement ($r = .16, p < .05$). Child negative emotionality was unrelated to any of the maternal instruction variables.

Table 3

Pearson correlations between predictor variables and child's academic and emotion regulatory behaviors at school entry ($N = 174$)

	1	2	3	4	5	6	7	8	9
(1) Maternal IQ	–								
(2) Maternal education	.45*	–							
(3) Maternal depression	.04	.00	–						
(4) Negative emotionality	.05	.07	.16**	–					
(5) Advanced organizers	.21*	.17**	–.00	–.01	–				
(6) Strategy instruction	.30*	.14**	–.05	–.02	.49*	–			
(7) Active cognitive	.24*	.16**	.01	–.03	.17**	.33*	–		
(8) Encouragement	.25*	.13	–.03	.02	.19*	.36*	.30*	–	
(9) Academic behaviors	.17**	.06	–.07	–.01	.13	.21*	.19*	.10	–
(10) Emotion regulatory behaviors	.15	.08	–.18**	–.08	.12	.22*	.20*	.06	.59*

* $p < .01$.

** $p < .05$.

Mediating relationships between maternal IQ, children's negative emotionality and maternal instruction with academic behaviors

After examining the Pearson correlations, possible mediating relationships between maternal IQ and maternal instruction variables were tested using hierarchical linear regressions. Then the relationship between maternal and child variables and school outcomes, as well as possible moderating relationships between the variables, were examined using the same method. Because only strategy instruction and active cognitive involvement were shown to have significant correlations with school outcomes, only these two variables were tested in the mediating and moderating models.

A mediating variable accounts for how or why a relationship is related to the dependent variable (Baron & Kenny, 1986). Mediation requires significant relationships between the independent and dependent variable ($A \rightarrow C$, for example, between maternal depression and child outcomes), between the independent and mediating variable ($A \rightarrow B$, for example, between maternal depression and education) and between the mediating and dependent variable ($B \rightarrow C$, for example, between maternal depression and child outcomes). Only when these conditions have been met can mediation be examined. Based on the previous research, it was hypothesized that maternal instruction might mediate the relationship between child and family variables and school outcomes. Two possible mediating relationships were discovered within the current study and subsequently tested. Maternal IQ was correlated with strategy instruction ($A \rightarrow B$) and with academic behaviors ($A \rightarrow C$). Strategy instruction was also correlated with academic behaviors ($B \rightarrow C$). To test for a mediating relationship, maternal IQ was entered first into a linear regression, predicting academic behaviors, and then strategy instruction was entered into the equation. The reduction in the beta coefficient for IQ ($\beta_1=.17, p<.05, \beta_2=.12, ns$) was consistent with a mediating relationship. Using the Sobel (1982) method discussed by Baron and Kenny (1986), the effect size of the attenuation in the beta coefficient was tested using a z test and found to be only marginally significant ($z=1.75, p<.10$).

A second potential mediating relationship was tested among maternal IQ, active cognitive engagement and academic behaviors. Initially, maternal IQ had a significant relationship ($\beta_1=.17, p<.05$); however, this became nonsignificant when active cognitive engagement was placed in the regression equation ($\beta_2=.13, ns$). Again, the reduction in the beta coefficient for IQ was consistent with mediation. The effect size of the attenuation in the beta coefficient was tested using a z test and found to be only marginally significant ($z=1.86, p<.10$).

Strategy instruction

It was hypothesized that maternal strategy instruction would predict children's early school outcomes. Additionally, it was hypothesized that aspects of maternal instruction may moderate the impact of other maternal and children's risk factors on school outcomes. To test these potential moderating relationships, maternal IQ, maternal education, maternal depressive symptoms on children's negative emotionality, and maternal strategy instruction were entered initially in separate equations for academic and ER adjustment, followed by two-way interaction terms involving maternal strategy instruction and the other predictors

(e.g., maternal education \times maternal strategy instruction) (see Table 4). The maternal variables of IQ, education and depressive symptoms, along with children's negative emotionality were entered first due to their earlier occurrence and their hypothesized influence on maternal instruction. Maternal strategy instruction was entered next.

The overall equation was not significant for academic behavior, but was so for ER behaviors (Adjusted $R^2=.08$, $p<.01$). The standardized residuals for the equations were examined and there were no outliers. Maternal education and strategy instruction were significant predictors of ER. In addition, the interaction between maternal education and strategy instruction was found to be significant for ER. Follow-up analysis of the interaction was examined using a procedure described by Aiken and West (1991), by testing the slope of the lines at low, medium and high levels of education. Examination of

Table 4

Hierarchical regressions predicting academic and emotion regulatory behaviors at ages 6 and 7: strategy instruction ($N=174$)

Variable	Academic behaviors				ER behaviors			
	<i>B</i>	<i>SE B</i>	β	ΔR^2	<i>B</i>	<i>SE B</i>	β	ΔR^2
Step 1				.02*				.02*
Maternal IQ	.01	.00	.16*		.01	.00	.15*	
Step 2				.00				.01
Maternal IQ	.01	.01	.17		.01	.01	.13	
Maternal Education	-.00	.03	-.01		.01	.03	.05	
Step 3				.01				.03*
Maternal IQ	.01	.01	.17*		.01	.00	.15	
Maternal education	.00	.03	-.02		.01	.03	.04	
Maternal depression	-.01	.01	-.11		-.02	.01	-.18*	
Step 4				.01				.00
Maternal IQ	.01	.01	.18*		.01	.00	.15	
Maternal education	.00	.03	-.01		.01	.03	.04	
Maternal depression	-.01	.01	-.09		-.01	.01	-.17*	
Negative emotionality	-.01	.01	-.08		-.01	.01	-.06	
Step 5				.01				.03*
Maternal IQ	.01	.01	.14		.01	.01	.10	
Maternal education	-.01	.03	-.02		.01	.03	.03	
Maternal depression	-.01	.01	-.08		-.01	.01	-.16*	
Negative emotionality	-.01	.01	-.08		-.01	.01	-.06	
Strategy instruction	.09	.05	.14		.11	.05	.17*	
Step 6				.01				.04
Maternal IQ	.01	.01	.14		.00	.00	.09	
Maternal education	.06	.08	.19		.20	.08	.58**	
Maternal depression	.00	.03	-.02		-.01	.03	-.18	
Negative emotionality	.00	.03	.21		-.00	.03	-.06	
Strategy instruction	.66	.41	.99		.83	.36	1.35*	
Strategy instruction \times maternal education	.02	.03	-.50		-.05	.02	-1.42**	
Strategy instruction \times maternal depression	.00	.01	-.07		.00	.01	.04	
Strategy instruction \times negative emotionality	-.01	.01	-.50		.00	.01	-.03	

Academic behaviors: Overall $F(8, 164)=1.69$, $p=.10$, $R^2=.03$.

ER behaviors: Overall $F(8, 164)=3.00$, $p=.004$, $R^2=.08$.

* $p<.05$.

** $p<.01$.

the slopes indicated that strategy instruction was associated with higher levels of emotion regulatory behaviors at low and medium levels of maternal education (slopes = 2.94 and 4.15; $p < .01$). This association was not significant at high levels of maternal education (slope = .40; *ns*). Thus, the moderating effects of maternal strategy instruction on child emotion-regulatory functioning appeared to be more robust for mothers with lower levels of educational attainment.

Active cognitive engagement

Similar to maternal strategy instruction, it was hypothesized that maternal active cognitive engagement would be directly linked to children's early school outcomes and

Table 5
Hierarchical regressions predicting academic and emotion regulatory behaviors at ages 6 and 7: active cognitive engagement ($N = 174$)

Variable	Academic behaviors				ER behaviors			
	<i>B</i>	<i>SE B</i>	β	ΔR^2	<i>B</i>	<i>SE B</i>	β	ΔR^2
Step 1				.02*				.02*
Maternal IQ	.01	.00	.16*		.01	.00	.15*	
Step 2				.00				.01
Maternal IQ	.01	.01	.17		.01	.01	.13	
Maternal education	-.00	.03	-.01		.01	.03	.05	
Step 3				.01				.03*
Maternal IQ	.01	.01	.17*		.01	.00	.15	
Maternal education	.00	.03	-.02		.01	.03	.04	
Maternal depression	-.01	.01	-.11		-.02	.01	-.18*	
Step 4				.01				.00
Maternal IQ	.01	.01	.18*		.01	.00	.15	
Maternal education	.00	.03	-.01		.01	.03	.04	
Maternal depression	-.01	.01	-.09		-.01	.01	-.17*	
Negative emotionality	-.01	.01	-.08		-.01	.01	-.06	
Step 5				.01				.03*
Maternal IQ	.01	.01	.14		.01	.01	.10	
Maternal education	-.01	.03	-.02		.01	.03	.03	
Maternal depression	-.01	.01	-.08		-.01	.01	-.16*	
Negative emotionality	-.01	.01	-.08		-.01	.01	-.06	
Strategy instruction	.09	.05	.14		.11	.05	.17*	
Step 6				.01				.04
Maternal IQ	.00	.01	.14		.00	.00	.11	
Maternal education	.14	.06	.38*		.15	.06	.43*	
Maternal depression	.00	.03	.05		-.03	.02	-.28	
Negative emotionality	-.01	.02	-.11		.00	.02	-.04	
Strategy instruction	.74	.28	1.38**		.65	.25	1.32**	
Strategy instruction \times maternal education	-.05	.02	-1.34**		-.04	.02	-1.33**	
Strategy instruction \times maternal depression	-.00	.01	-.19		.00	.01	.12	
strategy instruction \times negative emotionality	.00	.01	.10		.00	.01	-.01	

Academic behaviors: Overall $F(8, 164) = 2.64$, $p = .01$, $R^2 = .07$.

ER behaviors: Overall $F(8, 164) = 3.09$, $p = .003$, $R^2 = .09$.

* $p < .05$.

** $p < .01$.

moderate the impact of other maternal and children's risk factors on school outcomes. The same predictor variables were entered into a regression equation in relation to child outcomes, with the exception that maternal active cognitive engagement was substituted for strategy instruction. The overall model was found to be significant for academic behaviors (adjusted $R^2=.07$, $p<.01$) (see Table 5). With all of the maternal variables were entered into the equation, maternal education, maternal active cognitive engagement and the interaction between active cognitive engagement and maternal education remained significant. Using the same procedure described above (Aiken & West, 1991), examination of the slopes of the interaction indicated that active cognitive instruction was associated with higher levels of academic behaviors at low and medium levels of maternal education (slopes = 2.66 and 3.66; $p<.01$). Again, this association was not significant at high levels of maternal education (slope=.33; *ns*).

The overall model for children's ER behaviors was also significant (Adjusted $R^2=.09$, $p<.01$). With all of the other variables had been entered into the equation, maternal education and active cognitive engagement were significant predictors of the children's ER behaviors. The interaction between active cognitive engagement and maternal education was significant. Based on the pattern of the previous interactions, we explored these slopes using the procedure by Aiken and West (1991). Once again, the slopes of the interactions indicated active cognitive instruction was associated with higher levels of ER behaviors at low and medium levels of maternal education (slopes = 2.72 and 3.60; $p<.01$) but not at high levels of maternal education (slope=.48; *ns*).

Discussion

The goal of the present study was to apply Ladd et al. (1999) "child \times environment" framework to examine direct and potentially mediating and moderating relationships between maternal and child factors and early school outcomes. Some support was found for all three types of associations. First, direct relations, albeit modest, were evident between several child and maternal attributes and both academic and ER behaviors. Second, mediational effects were found for strategy instruction and active cognitive engagement in relation to the effects of maternal IQ on academic behaviors, although effect sizes were modest for such relationships. Third, strategy instruction and active cognitive engagement were found to moderate the effects of maternal education on academic and ER behaviors, respectively.

Children's characteristics

Contrary to previous research (Calkins, 1994; Ladd & Price, 1987; Martin, 1994), direct relationships were not found between children's negative emotionality and either academic or social outcomes. This result is surprising because we hypothesized that children who have difficulty maintaining emotional control may be particularly challenged learning and remaining emotionally calm in a classroom environment and in addition to be more challenging to interact with for adults, resulting in an unfriendly learning environment. However, positive relations in this area have emerged most often when the same

informant has been used to measure both child negative emotionality and child behavior in the same context or at the same time (Martin & Holbrook, 1983; Martin et al., 1988). The current study used mothers as informants when the children were toddlers and teacher reports at school entry, so the relationship between negative emotionality and school outcomes may have been attenuated by the use of multiple informants, the length of time between assessments, and the change of context for rating the child (i.e., home versus the school setting). Consistent with the current findings, other research examining the emergence of behavior problems in school-age children has found relationships between maternal report and child behavior problems, but has found this result to be modest to nonsignificant when informants other than the mother are used (e.g., Bates et al., 1985; Sanson, Oberklaid, Pedlow, & Prior, 1991; Shaw, Owens, Giovanelli, & Winslow, 2001).

Maternal characteristics

As hypothesized, direct relationships were found between maternal factors and later academic and ER outcomes. That maternal instruction was directly related to children's ER outcomes at school is particularly interesting, a finding that has previously not been examined in the literature. The connection between maternal instruction and academic problem solving has been established (e.g., Neitzel & Dopkins Stright, *in press*); however, its relation to children's ER in school suggests that maternal instruction also may benefit children's social relationships.

Relations between maternal depressive symptoms and children's academic behaviors did not emerge as they have in previous research (Goldsmith & Rogoff, 1995), but consistent with prior research (e.g., Greenberg et al., 1999), we did find an association between maternal depressive symptoms and children's ER. As much of the research studying maternal depression has focused on clinically depressed mothers, who had higher levels of depression than the majority of mothers in the current study, it is possible that level of maternal depression was sufficiently high to affect children's ER skills but not to impair academic functioning. Murray et al. (1996) found that the link between maternal depression and children's cognitive outcomes was accounted for by the mother's level of communication rather than only her emotional expression to the child. When maternal communication was controlled, the relationship between depression and children's developmental status was no longer significant. In relation to the present findings, it is possible that children's ER skills were impacted by their mother's consistent mild depressive symptoms, but that less impairment in mother's communication skills (i.e., inferred based on lower levels of depressive symptoms) may have limited the impact on children's academic success.

Similar to previous research, significant relationships were found between maternal preschool instruction and children's school outcomes (Dopkins Stright et al., 2001; Pianta et al., 1991; Pianta & Harbers, 1996). Maternal provision of strategy instruction and active engagement of the children were significantly related to children's academic success. It is possible that high levels of strategy instruction and task engagement in early childhood may facilitate children's problem solving and cooperation with peers and adults, both of which may be salient to later school success. Maternal instruction during the toddler years, in the form of strategy instruction and active cognitive engagement, was also found to be

significantly related to children's ER at school entry. As mentioned previously, this finding is notable in terms of its cross-domain breadth, and suggests that problem-solving strategies and instruction benefit children in both cognitive and social domains.

Interactions between children's and maternal characteristics

The foundation of the current paper was the “child \times environment” model which implies both direct and indirect interactions between the child and his/her environment. The current paper, however, only found one mediational effect and one moderating effect of maternal instruction on the child's adjustment at school entry.

Although previous research has found maternal depressive symptoms to be related to global parenting skills (Goldsmith & Rogoff, 1995), the literature on this issue is rather mixed (e.g., Lang et al., 1996; NICHD Early Child Care Research Network, 1999). Some previous research has found mother–child interactions to mediate the impact of depression on children's outcomes (e.g., Harnish, Dodge, & Valente, 1995), while others have found no differences (NICHD, 1999). Therefore, it is not entirely surprising that interactions between maternal depressive symptoms and instruction were not demonstrated in the current study. Even when effects of maternal depression have been found, such effects have been more robust for maternal sensitivity than for maternal depression (NICHD Early Child Care Research Network, 1999), supporting the current findings on maternal instruction.

The moderating relationships involving strategy instruction and active cognitive engagement with maternal education indicate that instruction was most important for children whose mothers had low or medium levels of education. The level of maternal strategy instruction and the degree to which a mother cognitively engages her child in the task may be more salient for children at greater risk for school difficulties. Understanding the relationship between maternal instruction and children's outcomes could help inform the curriculum for programs working with these children.

Few studies have examined explicit maternal strategy instruction and low-income children's strategy use in academic and emotion regulation settings. An explanation for the impact of explicit strategy instruction in low-income samples may be found in Kerkman and Siegler's (1993) research on children's addition strategy development. They found that although low-income children were able to adaptively select strategies to solve a mathematics problem, they tended to use ineffective strategies that middle income children never used. Siegler's (1993) hypothesis was that low-income children had less adequate mentoring for accurately assessing effective versus ineffective strategies. Mothers who provide direct mentoring in the use of strategies from a young age may provide children with a greater repertoire of effective problem-solving strategies from which the child can draw to solve both academic and social problems.

Finally, the finding that maternal instruction, both strategy instruction and active cognitive engagement, mediated the relation between maternal IQ and children's academic behaviors is noteworthy. It suggests that although IQ may be a highly heritable characteristic, its impact on children's behavior may be proximally accounted for by expressed levels of maternal instruction (Stoolmiller, 1999). Recent genetically informed research (i.e., twin design) on the heritability of IQ that used a heterogeneous sample of

families varying on socioeconomic status indicated that for middle-class families, a large percentage of variation in IQ was attributed to genetic influences, corroborating earlier reports. However, for lower class subjects, up to 60% of the variance was attributed to the shared environment (Turkeimer, Haley, Waldron, D'Onofrio, & Gottesman, 2003). In the current study, the relationship between maternal IQ and children's academic outcomes was found to be mediated by the quality of maternal instruction, albeit modestly, also suggesting the possibility that the transmission of intellectual skills may be altered by environmental influences.

Limitations

The present study has several limitations. First, although the equations predicting children's academic and ER outcomes were significant, the amount of variance accounted for in each equation was relatively modest. This indicates that the variables tested in the current study contribute to child outcomes, but in a relatively limited way. Second, the extrapolation of the results can only be generalized to boys from low-income, urban environments. Future research should include samples that are more representative of the population as a whole. Similarly, the inclusion of only male children limits the generalizability of the findings. Future research that includes girls would be important for examining the influence of gender on issues related to maternal instruction and child outcomes at school entry. The current study relied on a 3-min observation task which could be viewed to have limited ecological validity. However, studies in multiple domains have found similar time-limited tasks that encourage the expression of specific behaviors to be predictive of child adjustment over a span of 1 to 10 years (Gilliom et al., 2002; Pianta et al., 1991; Shaw et al., 1999). Finally, our measurement of maternal instruction included constructs that were composed of both instructional and emotional components of parenting. We recognize that the composition of this variable makes it difficult to draw conclusions about the specific aspects of parenting which lead to child outcomes.

The current study began to investigate the complex mediating and moderating relationships between family and child factors specifically focusing on maternal instruction. The findings help to inform the current body of knowledge on early school outcomes, yet raise as many new questions as they answer. The results do suggest that examining quality of maternal instruction prior to formal school entry may be useful as a predictor of school adjustment, particularly within the context of an ecologically based assessment of the child and family.

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