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A Closer Look at Teacher–Child Relationships and Classroom Emotional Context in Preschool

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Abstract

Background Children's early classroom experiences, particularly their interpersonal interactions with teachers, have implications for their academic achievement and classroom behavior. Teacher–child relationships and classroom interactions are both important aspects of children's early classroom experiences, but they are not typically considered together in studies of early childhood classrooms. The bioecological model suggests that both uniquely impact children's development.

Objective The objective of this study was to examine the joint impact of individual teacher–child relationships reported by the teacher and observed classroom interactions to identify associations between these and children's outcomes.

Methods Using the Early Childhood Longitudinal Study—Birth cohort, multiple regression was employed to test the hypothesis that teacher–child relationships and classroom interactions are uniquely related to children's classroom behavior and academic achievement. Further, a moderation model was tested to examine the moderating impact of teacher–child relationships on the association between classroom interactions and children's outcomes.

Results Teacher–child relationships were related to children's concurrent academic achievement and classroom behavior, and to children's classroom behavior assessed one year later. No main effects of classroom interactions were identified; however, teacher–child relationships moderated the associations between classroom interactions and children's preschool classroom behavior.

Conclusions Findings suggest that teacher–child relationships are important for children's development in classrooms, even after accounting for classroom interactions.

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Professional development for teachers and measurement in classroom research should address teacher–child relationships in addition to classroom interactions.

Keywords Teacher–child interactions · Teacher–child relationships · Preschool

Introduction

Children's experiences in early childhood classrooms have significant influence on their social and emotional development (Baker et al. 2008; Hamre and Pianta 2001) and academic achievement (Hamre and Pianta 2001; National Institute of Child Health and Human Development Early Child Care Research Network [NICHD-ECCRN] 2005; Institute of Medicine [IOM] and National Research Council [NRC] 2015; Vitiello et al. 2012). One of the most salient people involved in children's classroom experiences is the teacher. Teachers provide learning opportunities, facilitate the days' activities, guide behavior, and foster peer relationships among the children in their class. Over the past two decades, a growing literature has deepened our understanding of the interpersonal dynamics of teachers and children as a critical component of early childhood classrooms. The relationships and interactions that occur between teachers and children influence children's academic achievement (Burchinal et al. 2008; Curby et al. 2009b; Mashburn et al. 2008), classroom behavior (Myers and Pianta 2008), and social competence (Burchinal et al. 2008; Curby et al. 2009a). These interactions provide support, scaffolding, and information to enhance children's growth in the classroom.

Though increasing attention has been paid to improving the quality of early childhood education, much of this work has emphasized establishing an overall classroom context comprised of emotionally sensitive interactions, without specifically attending to the unique relationships teachers have with individual children (Tout et al. 2010). Recent work, however, suggests that individual teacher–child relationships play a crucial role in children's early school readiness and longer-term trajectories of academic success (Blair et al. 2016; Rudasill et al. 2013). This research suggests that both dimensions of quality are important; individual teacher–child relationships and emotionally sensitive classroom contexts may be necessary for children's school success. Unfortunately, these two sets of interpersonal dynamics are rarely considered simultaneously to understand their unique and combined relations with children's academic achievement and positive classroom behavior.

Using the process-in-context perspective of the bioecological model (Bronfenbrenner and Morris 2006), the current study seeks to extend this literature and add to the growing dialogue about the complex interpersonal dynamics of early childhood classrooms. We pursue this by examining the unique contribution of teacher–child relationships and classroom emotional context to children's classroom behavior and academic achievement. We draw on nationally representative data from the Early Childhood Longitudinal Study—Birth Cohort (ECLS—B) to examine these associations in preschool settings as related to children's academic skills and behavioral outcomes both concurrently and one year later in kindergarten.

Process-in-Context Framework

The Process-Person-Context-Time (PPCT) model of the bioecological systems perspective (Bronfenbrenner and Morris 2006), posits that *proximal processes* are the engines that

drive development. We suggest that teacher–child relationships are the ongoing *proximal processes* that drive children's development in early childhood classrooms. Teacher–child relationships are the cumulative and ongoing interpersonal connections between individual children and their teacher, made up of interactions, expectations, and affective quality over time (Pianta 1999) and are assessed in terms of dyads. Relationships are best identified as the proximal processes in children's classroom experience because of the direct involvement of the child and the on-going nature of the relationship. In turn, we identify classroom level interactions, and the sensitivity and responsiveness of the classroom emotional context in particular, as the context in which these proximal processes occur. As such, the classroom emotional context comprises the moment-to-moment verbal and non-verbal exchanges between teachers and one or more children, and are typically measured at the classroom level (i.e. average experience of the classroom). The context aspect of the PPCT model is well captured by the construct of classroom interactions, here classroom emotional context, because of the more distal nature from the child and the measurement of these interactions for a short duration of time. Thus, we examine classrooms with a *process-in-context* lens. We do this by examining unique main effects of the process and context, as well as the modifying potential of the proximal process on associations between the context and children's outcomes.

Pianta et al. (2003) offer a similar perspective on the bioecological systems theory as applied to classrooms. According to this perspective, relationships are "enduring patterns of interaction between children and adults" (p. 204) that critically contribute to child development and exist within the context of larger systems such as the preschool classroom. This suggests that both proximal systems (e.g., individual teacher–child relationships) and the more distal systems in which they are embedded (e.g., the classroom emotional context) have the potential to exert influence on individual development (Pianta et al. 2003). General support for this perspective comes from research demonstrating a consistent link between teachers' relationships with individual children and those children's social and emotional development (Griggs et al. 2009; Palemo et al. 2007), and academic outcomes (Graziano et al. 2007; Liew et al. 2010). In addition, research suggests emotionally sensitive classroom contexts are important facilitators of children's engagement in the classroom (Ridley et al. 2000) and learning and development (Burchinal et al. 2010; Curby et al. 2009a, b). The current study uses this process-in-context lens to examine the unique associations among both proximal and distal systems and children's developmental outcomes across time. Both socio-emotional and academic outcomes are examined to contribute to literature documenting the cross-domain associations between teacher support and children's outcomes (Downer et al. 2010).

Teacher–Child Relationships

Teacher–child relationships refer to the on-going interpersonal connections that develop over time between teachers and individual children in their classroom. Though behavioral indicators of such relationships could be assessed through repeated observations over extended periods of time, teacher–child relationships are typically measured by means of teacher report, often using the Student Teacher Relationship Scale (STRS; Pianta and Steinberg 1992). As such, teacher–child relationships reported in the literature most often reflect the teacher's perception of the relationship; for parsimony, we here forward refer to these perceptions as teacher–child relationships. Relationships are built up from interactions between two individuals and are thereby shaped by the characteristics, behaviors, expectations, and perceptions of each individual. At the same time, relationships are not

simply the sum of interactions or influences, but rather a distinct entity on their own (Pianta 1999).

Teacher reports of teacher–child relationships have been consistently linked to children's social relationships, classroom behavior, and academic achievement, having lasting effects through elementary and middle school (Hamre and Pianta 2001). Warm and positive relationships are associated with better school adjustment for children (Baker et al. 2008). In contrast, children in teacher–child relationships marked by conflict have been shown to exhibit more problematic classroom behaviors (Pianta et al. 1997), even when accounting for children's behavior at the beginning of the school year (Graves and Howes 2011). Similarly, Graziano et al. (2007) found a significant association between teacher–child relationships and children's scores on measures of academic ability in reading and math, after controlling for children's IQ scores and behavior problems.

Classroom Emotional Context

In the current study, classroom emotional context refers to the sensitivity and responsiveness of verbal and non-verbal behaviors, communications, and exchanges that generally occur between teachers and the children in their classroom (Arnett 1989). In educational research, classroom context is often conceptualized and measured at the classroom level (using observational methods) to capture the experience of the average child in the classroom (Pianta et al. 2008) or the average of the classroom as a whole (Harmes et al. 2004). Emotionally supportive classroom contexts characterized by high levels of warmth and responsiveness and low levels of negativity have been consistently linked to more social competence and fewer behavior problems among children (Burchinal et al. 2010; Curby et al. 2009a). Some research further suggests that classroom emotional support also promotes positive outcomes in cognitive domains, but this research is less consistent (Downer et al. 2010).

Examining Classrooms at Two Levels: Process-in-Context

Though studies examining individual teacher–child relationships and classroom emotional context together are not common, those available support the notion that children within the same classroom may have different experiences. In the most comprehensive study to date, Jeon and colleagues found that although observed global classroom quality (including both structural characteristics and the classroom emotional context) and teacher reported relationships were correlated, they each were uniquely related to children's social skills; neither was related to academic skills (Jeon et al. 2010). Other studies of joint contributions of teacher–child relationships and overall classroom contexts have reported mixed findings. Graves and Howes (2011), for example, demonstrated significant associations between teacher–child relationships and children's peer social skills, frustration tolerance, and conduct problems, but no significant effects of the classroom's emotional context. Cadima et al. (2015) similarly found no associations between classroom emotional context and child self-regulation outcomes in models accounting for teacher–child relationships.

These equivocal findings raise the question of how teacher–child relationships and the classroom level emotional context work in tandem to impact diverse child outcomes. It may be, for example, that the emotional context of the classroom creates an upper and lower limit on the potential closeness and conflict in individual children's relationships with the teacher(s) in that classroom. Jeon and colleagues found that children's individual experiences of global quality were related to, but not dictated by, the more distal system of

classroom quality (Jeon et al. 2010). For example, 47% of children in their sample were identified as being in "good" quality classrooms, yet 62% of those children in "good" classrooms were not observed to have "good" individual experiences. Understood from a process-in-context perspective, one reason individual children may experience the same classroom differently is their unique relationship with the teacher. In regard to the mixed finding from prior research, this framework suggests that teacher–child relationships and classroom emotional context may contribute to children's outcomes in complex ways which require further study.

The Current Study

The current study seeks to address these gaps in current research by examining the unique and joint contributions of teacher–child relationships and classroom emotional context to children's developmental competencies in preschool and one year later. More specifically, we use nationally representative data from the Early Childhood Longitudinal Study—Birth Cohort (ECLS—B) to address the following research aims:

Aim 1 To examine the unique associations of preschool teacher–child relationships and classroom emotional context with children's early academic skills and classroom behavior concurrently and one year later.

Aim 2 To examine the extent to which preschool teacher–child relationships moderate the associations between preschool classroom emotional context and children's early academic skills and classroom behavior concurrently and one year later.

In accordance with the propositions of the bioecological systems perspective (Bronfenbrenner and Morris 2006) and previous literature, our hypotheses regarding aim 1 are that teacher–child relationships and classroom emotional context will be uniquely positively associated with children's academic and behavioral competencies. Further, in regard to aim 2, we hypothesize that the association between classroom emotional context and child outcomes will be stronger when children have more positive teacher–child relationships at the individual level (i.e., evidence of moderation), given that distal systems influence development in relation to proximal systems.

With detailed information about young children's family background and experiences in early care environments, the ECLS-B offers several advantages for addressing our study aims. First, measures of both teacher–child relationships and classroom emotional context are rarely available together in the same dataset as they are in the ECLS-B. Second, the longitudinal aspect of the ECLS-B allows us to incorporate data on children's prior cognitive and social-emotional functioning at two years of age and to examine children's outcomes both in preschool and one year later at age five. Including the age two variables helps us to minimize omitted variables bias and address the possibility that teachers respond differently to children based on their initial skill levels; including the age five data helps to address concerns about potential mono-reporter bias during the preschool year, when teachers report on both relationships and child behavior. Use of these data in de-identified format were provided through restricted data license agreements with the Institute of Education Sciences Data Security Office within the US Department of Education (licenses #16010008; #07060001).

Method

Data Source and Analytic Sample

The ECLS-B is a unique prospective study that followed a birth cohort of children (n = 10,700) from infancy to kindergarten entry. Using a clustered, list-frame sampling design based on birth certificate data, it provides representative information for the nearly 4 million infants born in the United States in 2001 (Flanagan and West 2004). Detailed information from multiple contexts (e.g., child, home, early care environments) was collected at four time points when children were approximately 9 months (baseline), 2, 4, and 5 years of age—through a variety of methods including home visits, parent and care provider interviews, direct child assessments, and child care observations. Response rates for the 2-, 4-, and 5-year old data collections were 92, 90, and 66%, respectively. The final wave of data collection (at age 5) was intentionally smaller as only 85% of the original sample was recruited due to budgetary constraints. Additional details about the study sample and design are available on the NCES website: http://nces.ed.gov/ecls/birth.asp.

Our analyses utilize the ECLS-B participants who were enrolled in center-based care at wave 3 of data collection (age 4, preschool) and were targeted for observation by the national study team, given that the observation of the child's classroom is central to our study (for additional detail, Najarian et al. 2010). This sample consists of 1400 children who were targeted for observation, enrolled in center-based care, and whose care provider agreed to participate. Our final analytic sample of 1100 children excludes 150 cases without a valid child cognitive assessment score at age 4 and 150 cases in which the provider responding to the caregiver interview differed from the provider observed during the direct observation. There were virtually no missing data (<1%) for any of the other study variables within this sample. To help correct estimates and standard errors for the complex sampling design of the ECLS-B and potential nonresponse bias from missing study components (either because of study design or participant refusal) and overall attrition, the NCES created several child-level sample weights and jackknife replicate weights in the dataset (Snow et al. 2007). Using these weights, our analytic sample is nationally representative of children born in 2001 who were enrolled in center-based care for 10 or more hours a week at the preschool wave of data collection. The basic demographic characteristics of our analytic sample are presented in Table 1. In accordance with confidentiality requirements of the NCES, all unweighted sample sizes reported here have been rounded to the nearest 50.

Design and General Procedures

The design of the current study in an observational cohort study. The majority of the data used in this study was taken from the age 4 data collection for models examining concurrent associations among teacher–child relationships, classroom emotional climate, and children's outcomes. Data from age 5 data collection is used to examine longitudinal associations among preschool teacher–child relationships, preschool classroom emotional climate, and children's outcomes a year later. These longitudinal analyses also help to reduce mono-reporter bias in the behavior models. Covariates from age 2 data collection are included to help minimize omitted variable bias.

Table 1 Sample demographic characteristics (n = 1100). *Source*: National Center for Educational Statistics, early childhood longitudinal study-birth cohort, 9-month—Kindergarten restricted use data file

	M or %	SD
Child characteristics		
Child age (in mos.) at Wave 3	52.85	3.98
Child is in kindergarten at Wave 4	78%	
Child's race/ethnicity		
White, non-Hispanic	55%	
Black, non-Hispanic	15%	
Hispanic	22%	
Asian, non-Hispanic	3%	
Other, non-Hispanic	4%	
Child has immigrant parent(s)	21%	
Family characteristics		
Average income-to needs ratio[a]	3.15	2.72
Highest level of parent education	4.91	2.06

Estimates are weighted by W33P0 to account for sampling design

[a] The income-to-needs variable represents households' average income relative to the federal poverty line (adjusted for year and family size) over the first three waves (measured at 9, 24 mos., and 4 years)

Measures

Independent Variable: Preschool Individual Teacher–Child Relationships

As part of the caregiver telephone interview, preschool teachers responded to a subset of items from the Student–Teacher Relationship Scale (STRS; Pianta and Steinberg 1992) to describe the quality of their relationship with individual children. The original STRS measure contains 28 items across three subscales (closeness, conflict, and dependency). The version used in the ECLS-B included three items measuring conflict ("[child] and I always seem to be struggling with each other", "remains angry or is resistant after being disciplined", "if [child] arrives in a bad mood, I know we're in for a long and difficult day") and three items measuring closeness ("if upset [child] will seek comfort from me", "is easy to be in tune with", and "is uncomfortable with physical affection or touch from me" [reverse-coded]). Using a three-point scale (1 = never true, 2 = sometimes true, 3 = always true), teachers rated how often each statement applied to their relationship with the target child. Exploratory factor analyses of the ECLS-B data indicated two factors consistent with the original subscales from which the items were drawn, conflict and closeness. For the current analysis, a mean *teacher–child conflict* score was calculated across the three relevant items (α = 0.70), with higher scores reflecting more conflictual relationships. Given that the physical affection item loaded weakly on both factors and had skewness and kurtosis values beyond the recommended range (Kline 1998), it was dropped from the analysis. A mean *teacher–child closeness* score was calculated based on the two remaining items (comforting and being in tune) (α = 0.40). Despite the low alpha (which is to some extent a function of having only two items), we decided to retain the closeness variable in the analysis so as not to focus only on the negative side of teacher–child

relationships. We also consider the implications of measurement limitations in our discussion of the study results.

Independent Variable: Preschool Classroom Emotional Context

The Caregiver Interaction Scale (CIS) is a 26-item observational measure of classroom emotional context reflecting the degree to which a caregiver's interactions (at the classroom level) are marked by positive and punitive exchanges, detachment, and permissiveness (Arnett 1989). Trained observers used a 4-point scale ranging from "not at all" to "very much" to indicate how well each statement (e.g., listens attentively when children speak) described the caregiver's behavior. The CIS has been used in several large-scale child care studies, as well as multiple state Quality Rating Improvement Systems (QRIS) to evaluate early childhood program quality. It has been reported to have good internal consistency and to be moderately correlated with broad-based measures of classroom quality such as the Early Childhood Environment Rating Scale (ECERS) (e.g. Layzer et al. 1993; Phillipsen et al. 1995). In the ECLS-B, the CIS was completed during a preschool observation visit by trained observers who spent at least 2 hours in the child's primary care setting (for additional details on training procedures, see Nord et al. 2006). This observation focused on the classroom teacher who had completed the STRS and considered the teacher's interactions with all children in the classroom. Items were combined into a total score ranging from 0 to 78 points ($\alpha = 0.95$) with high scores indicating interactions marked by warmth, engagement, and the use of consistent and appropriate discipline strategies. As in other datasets, we found that the CIS and the ECERS are moderately, but not highly, correlated ($r = 0.33$), which is not surprising given that the former is more narrowly focused on a single dimension of quality (i.e., classroom emotional context).

Dependent Variable: Children's Academic Skills

Children's early reading and math skills were directly assessed at age 4 and age 5 using a set of cognitive batteries constructed by NCES for the ECLS-B and its companion study, the ECLS-K (see Rock and Pollack 2002). Items were compiled from several well-established assessment tools, and Item-Response Theory (IRT) methods were used to create overall scale scores for reading and math based on the pooled set of items from both waves of the ECLS-B (see Najarian et al. 2010 for details). The IRT scale scores can be interpreted as the number of items a child would have answered correctly if they had received the full set of items (85 for reading and 71 for math). Internal reliability of the IRT scores is relatively high, with alpha coefficients of 0.84 and 0.89 for the preschool reading and math assessments respectively, and 0.93 and 0.92 for the same assessments at age 5 (Najarian et al. 2010). These cognitive assessments were administered only in English; a very small sample of children (<1%) did not complete the assessment based on the results of a language screener for English fluency.

Dependent Variable: Children's classroom Behavior

Classroom teachers reported on children's classroom behaviors at age 4 and age 5 (different teachers) using a subset of items from two established measures, the Preschool and Kindergarten Behavioral Scales—Second Edition (PKBS-2; Merrell 2003) and Social Skills Rating System (SSRS; Gresham and Elliott 1990). Using a 5-point scale (0 = never;

5 = very often), teachers rated how often in the last 3 months the child had demonstrated 20 different behaviors. As suggested by NCES (Snow et al. 2007), we conducted a factor analysis of these items and found support for two factors: positive classroom behavior (10 items; α = 0.98 at age 4; α = 0.97 at age 5) and problematic classroom behavior (9 items; α = 0.98 at age 4; α = 0.96 at age 5). Examples of positive behaviors are showing eagerness to learn new things, making friends easily, paying attention, and sharing with other children. Problematic behaviors include impulsivity, physical aggression, difficulty concentrating, and temper outbursts or tantrums.

Child, Family and Setting Characteristic Covariates

Covariates included the highest level of parent education (1–9), household income-to-needs ratio, child age (in months), child race-ethnicity, and family immigrant status. In all analyses, Hispanic children serve as the omitted referent group. All models also controlled for the observed child-to-adult ratio of children's preschool classrooms given its potential influence on interpersonal dynamics within that setting. Child gender was not included in the final models because preliminary analyses suggested it was not a significant predictor. In the models predicting age 5 outcomes, an indicator for kindergarten entry status was also included. Approximately 78 percent of the sample had entered kindergarten by the time of the age 5 data collection, with the remainder attending a second year of preschool.

Additional covariates where drawn from age 2 data collection and included in an effort to address omitted variable concerns. In the models predicting children's reading and math, children's cognitive skills at age 2 were included as controls. Age 2 cognitive abilities were assessed directly using a shortened version of the Bayley Scales of Infant Development, Second Edition (BSID-II; Bayley 1993). In the models predicting children's classroom behavior, we also included a measure of children's temperament at age 2, based on interviewer ratings of affect, adaptability, sociability and engagement made during the administration of the BSF-R assessment (using a subset of items from the Behavior Rating Scale, a supplementary component of the BSID-II). For the purposes of this study, we created a composite score for the five items of Behavior Rating Scale (α = 0.81) as a measure of children's temperament at age 2.

Data Analysis

Means and standard deviations of independent and dependent variables are presented in Table 2. To address our first research aim (Aim 1) concerning the associations among the independent variables of teacher–child relationships and classroom emotional context and the dependent variables of children's academic skills and classroom behavior, we estimated a series of OLS multivariate regression models using the *svy* package of commands in Stata/SE 12.1 (StataCorp 2011), which allows for the incorporation of sampling weights and jackknife replicates. In the first set of models, we regressed each preschool developmental indicator—reading skills, math skills, positive behavior, and problem behavior at preschool—on our measures of individual teacher–child relationships (conflict and closeness) and classroom emotional context in preschool, controlling for a basic set of child, family, and program characteristics, as well as a measure of children's skills at age 2. In a second set of regression models, we examined whether preschool teacher–child relationships and classroom emotional context were related to academic skills and classroom behavior in kindergarten.

Table 2 Descriptive information for key predictor and outcome variables. *Source*: National Center for Educational Statistics, Early Childhood Longitudinal Study—Birth Cohort, 9-month—Kindergarten restricted use data file

	M	SD
Quality of preschool classroom experiences		
Sensitivity of classroom emotional context (0–78)	64.84	12.16
Teacher–child closeness (1–3)	2.44	0.42
Teacher–child conflict (1–3)	1.30	0.44
Observed child–adult ratio	7.22	2.98
Age 2 child outcomes		
Mental skills scores (BSF-R)	51.49	10.73
Interview rating of affect and sociability (1–5)	3.64	0.83
Age 4 child outcomes		
Early reading skills	26.90	10.82
Early math skills	30.94	10.06
Positive classroom behaviors (1–5)	3.80	0.61
Problematic classroom behaviors (1–5)	2.07	0.81
Age 5 child outcomes		
Early reading skills	42.57	15.44
Early math skills	42.50	9.74
Positive classroom behaviors (1–5)	3.97	0.65
Problematic classroom behaviors (1–5)	1.94	0.43

To account for sampling design, Age 4 estimates are weighted by W33P0; Age 5 estimates are weighted by W43P0. Values for early reading and math skills reflect age-based percentile scores

To address Aim 2, we added two interaction terms to each regression model to examine the moderating effect of teacher–child relationships on the associations between classroom emotional context and outcomes at ages 4 and 5, respectively. To determine the nature of significant interactions, we conducted a series of simple slope analyses (see Aiken and West 1991) and plotted the relationship between preschool classroom emotional context and child outcomes conditional on level of teacher–child relationship quality.

Results

Associations Among Teacher–Child Relationships and Classroom Emotional Context

Results from the OLS regression models testing whether individual teacher–child relationships and classroom emotional context are uniquely associated with children's academic skills and classroom behavior are shown in Table 3 (preschool outcomes) and Table 4 (age 5 outcomes). As a sensitivity test, models were also estimated with each predictor (i.e., relationships or emotional context) on its own; the results did not vary from those reported, suggesting that teacher–child relationships and classroom emotional context are distinct and have unique effects.

Preschool Academic Skills and Classroom Behavior

Across the four preschool outcomes, we observe a consistent negative association between teacher–child conflict in individual relationships and children's early skills, though the R^2 was quite small. Children whose teachers report having a more conflictual relationship with

Table 3 Regression analyses predicting age 4 academic and behavioral skills from teacher–child relationships and classroom emotional context in preschool, full sample (n = 1100). *Source*: National Center for Educational Statistics, Early Childhood Longitudinal Study—Birth Cohort, 9-month-Kindergarten Restricted Use Data File

	Age 4 reading skills	Age 4 math skills	Age 4 positive behavior	Age 4 problem behavior
Classroom emotional context	−0.05 (0.04)	−0.03 (0.03)	0.00 (0.00)	0.00 (0.00)
Preschool teacher–child closeness	1.50 (1.01)	0.61 (0.89)	0.41*** (0.05)	−0.26*** (0.07)
Preschool teacher–child conflict	−2.72** (0.90)	−1.67* (0.83)	−0.59*** (0.06)	1.23*** (0.07)
Preschool adult:child ratio	0.21 (0.17)	0.15 (0.11)	0.00 (0.01)	0.01 (0.01)
Child age (in months)	1.06*** (0.10)	1.13*** (0.09)	0.01 (0.01)	0.00 (0.01)
Child is (non-Hispanic) White	2.02 (1.47)	0.01 (0.96)	−0.04 (0.10)	−0.03 (0.10)
Child is (non-Hispanic) Black	1.53 (1.17)	0.63 (1.03)	−0.08 (0.09)	−0.03 (0.09)
Child is Asian	5.00** (1.59)	1.76 (1.31)	0.06 (0.11)	−0.10 (0.12)
Child is "other" race/ ethnicity	3.36[†] (1.75)	0.67 (1.36)	−0.06 (0.10)	0.16 (0.12)
Child of immigrant parent(s)	0.788 (0.94)	2.13* (0.85)	−0.08 (0.08)	−0.07 (0.08)
HH income-to-needs[a]	0.90*** (0.25)	0.98*** (0.22)	−0.01 (0.01)	0.00 (0.01)
Highest level of parent education	0.51 (0.36)	0.80** (0.24)	0.03[†] (0.02)	−0.02 (0.02)
Age 2 developmental status[b]	0.33*** (0.03)	0.29*** (0.03)	0.06** (0.02)	−0.01 (0.03)
Constant	−51.8*** (7.01)	−50.40*** (5.66)	2.87*** (0.36)	1.48** (0.44)
Adjusted R-square	0.39	0.44	0.31	0.46

Estimates are weighted by W33P0 to account for sampling design. Standard errors appear in parentheses

[a] The income-to-needs variable represents households' average income relative to the federal poverty line (adjusted for year and family size) across the first three waves (measured at 9, 24 mos., and 4 years)

[b] The age 2 measure of development is the Bayley mental skills scale for models predicting academic skills, and an observer rating of child temperament for models predicting classroom behavior

[†] $p < 0.10$

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

them scored lower in reading and math, even after accounting for background characteristics and children's cognitive skills at age 2. On the other hand, we find no significant associations between observed classroom emotional context and children's academic skills or classroom behavior. Covariates explained an additional 38% of the variance in reading skills and 44% of the variance in math skills.

As shown in the third and fourth columns of Table 3, we find consistent associations between teacher–child relationships and children's classroom behavior at preschool, even

Table 4 Regression analyses predicting Age 5 academic and behavioral skills from teacher–child relationships and classroom emotional context in preschool, full sample (n = 1100). *Source*: National Center for Educational Statistics, Early Childhood Longitudinal Study–Birth Cohort, 9-month-Kindergarten Restricted Use Data File

	Age 5 reading skills	Age 5 math skills	Age 5 positive behavior	Age 5 problem behavior
Classroom emotional context	−0.05 (0.05)	−0.01 (0.04)	0.00 (0.00)	0.00 (0.00)
Preschool teacher–child closeness	0.40 (1.55)	−0.69 (1.14)	0.24** (0.08)	−0.13 (0.08)
Preschool teacher–child conflict	−2.95 (2.50)	−1.13 (1.18)	−0.43*** (0.09)	0.72*** (0.09)
Preschool adult:child ratio	0.01 (0.29)	−0.15 (0.17)	0.01 (0.01)	0.02 (0.01)
Child age (in months)	1.31*** (0.30)	0.92*** (0.16)	0.03† (0.02)	−0.02 (0.01)
Child in kindergarten at Age 5	6.33** (2.23)	2.97* (1.31)	−0.43*** (0.10)	0.31*** (0.08)
Child is (non-Hispanic) White	0.51 (5.61)	2.62 (2.69)	0.02 (0.08)	−0.01 (0.13)
Child is (non-Hispanic) Black	−0.38 (3.71)	0.38 (2.08)	−0.05 (0.10)	0.04 (0.12)
Child is Asian	5.95 (3.60)	4.13† (2.28)	−0.13 (0.13)	−0.03 (0.11)
Child is "other" race/ ethnicity	−1.64 (4.63)	1.82 (2.54)	0.00 (0.16)	0.33* (0.16)
Child of immigrant parent(s)	1.55 (3.26)	2.51 (1.74)	0.16† (0.09)	−0.20* (0.09)
HH income-to-needs[a]	0.64* (0.30)	0.64** (0.20)	0.01 (0.02)	0.03 (0.02)
Highest level of parent education	1.80*** (0.47)	0.63† (0.33)	0.04† (0.03)	−0.11*** (0.03)
Age 2 developmental status[b]	0.43*** (0.10)	0.29*** (0.05)	0.07 (0.04)	−0.07† (0.04)
Constant	−75.85*** (16.20)	−36.80*** (9.42)	1.85† (0.99)	3.22*** (0.93)
Adjusted R-square	0.43	0.42	0.21	0.30

Estimates are weighted by W43P0 to account for sampling design. Standard errors appear in parentheses

[a] The income-to-need variable represents households' average income relative to the federal poverty line (adjusted for year and family size)across the first three wave (measured at 9, 24 mos., and 4 years)

[b] The age 2 measure of development is the Bayley mental skills scale for models predicting academic skills, and an observer rating of child temperament for models predicting classroom behavior

† $p < 0.10$

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

after accounting for child temperament at age 2. Conflict, in particular, accounted for a large portion of the variance in children's behavior (positive behavior $R^2 = 0.19$, problem behavior $R^2 = 0.42$). Teacher reports of higher levels of closeness and lower levels of conflict were associated with more favorable ratings of child behavior.

Age 5 Academic Skills and Classroom Behavior

Similar to the preschool results, we find no significant associations between observed classroom emotional context and children's outcomes at age 5 (see Table 4). We also find no significant associations between teacher–child relationships at preschool and children's age 5 academic skills. Significant associations emerged, however, in the behavior domain. Children whose preschool teachers reported high levels of conflict in their relationship were rated by their kindergarten teachers as having less positive and more problematic behavior. Conversely, teacher–child closeness at preschool was positively associated with children's positive classroom behavior at kindergarten.

Potential Moderation

In addition to the unique associations among teacher–child relationships and classroom emotional context, we were interested in potential moderation effects of teacher–child relationships on associations between classroom emotional context and children's outcomes. On the one hand, having a positive relationship with one's teacher may offset the negative effects of a less sensitive and responsive classroom emotional climate (or vice versa). On the other hand, it may be that a sensitive and responsive emotional context and positive individual relationships primarily promote positive child outcomes when experienced in the presence of each other. We explore this question by including two interaction terms in the regression models described above (teacher–child closeness x classroom emotional context and teacher–child conflict x classroom emotional context). Given the limited findings and in the interest of space, these models are summarized here, but not presented individually (available from authors upon request).

Across our eight outcome variables (four at each age), two significant interaction effects emerged and both pertained to children's classroom behavior at preschool. First, conflict in teacher–child relationships significantly moderates the association between classroom emotional context and preschool positive behavior, as indicated by a significant two-interaction term between teacher–child conflict and classroom emotional context ($b = 0.006$, $t = 2.00$, $p < 0.05$). To further probe this interaction, we plotted the relationship between sensitivity of the classroom emotional context (at $-1SD$ and $+1SD$) and child behavior conditional on the minimum and maximum value of teacher–child conflict (i.e., 1 and 3 respectively) and conducted a simple slopes analysis (see Aiken and West 1991). Results indicated that classroom emotional context is significantly associated with child positive behavior at each level of teacher–child conflict, but is stronger for children who have more conflictual relationships with their teacher. Plots of the marginal effects are shown in Fig. 1, and suggest that children whose relationship with their teacher was marked by low conflict had similarly high levels of positive behavior regardless of the overall classroom emotional context. In contrast, children in highly conflictual teacher–child relationships exhibited less positive behavior in the context of less emotionally sensitive classrooms than in more emotionally sensitive classrooms. A similar pattern of results was evident for child problem behavior in preschool, such that its association with classroom emotional context is moderated by teacher–child conflict ($b = -0.009$, $t = -2.54$, $p < 0.05$). Again, the simple slopes analysis indicated that interaction quality is a significant predictor of problem behavior at each level of teacher–child conflict, but this association is stronger for children in highly conflictual teacher–child relationships (see Fig. 2).

Fig. 1 Interaction between the quality of preschool classroom emotional context and teacher–child conflict to predict child positive behavior at age 4. A simple slope analysis indicates significant associations ($p < 0.001$) with children's positive behavior at each combination of ±1 SD positive emotional context and the minimum (1) and maximum (3) value of relationship conflict
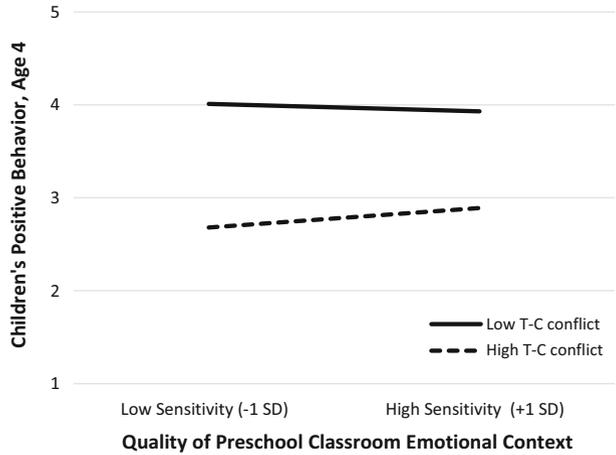

Fig. 2 Interaction between the quality of preschool classroom emotional context and teacher–child conflict to predict child problem behavior at age 4. A simple slope analysis indicates significant associations ($p < 0.001$) with children's problem behavior at each combination of ±1 SD positive emotional context and the minimum (1) and maximum (3) value of relationship conflict
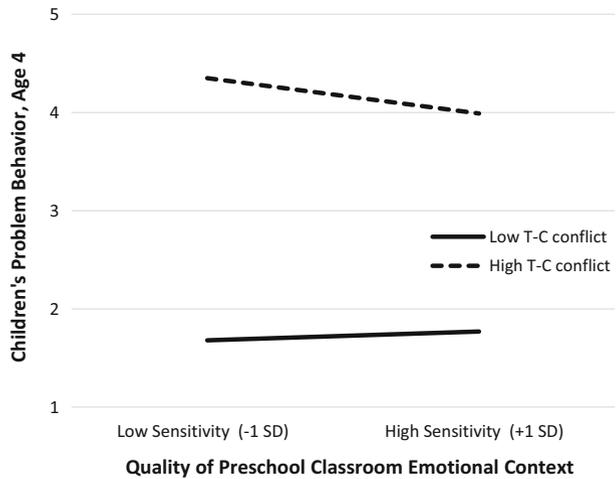
Discussion

Drawing on a process-in-context model of early childhood classrooms (Bronfenbrenner and Morris 2006; Pianta et al. 2003) this paper examined two conceptually related, but distinct components of children's experiences in preschool classrooms—individual teacher–child relationships and the overall emotional context of the classroom—and their associations with young children's academic skills and behavior. Amidst growing evidence that teacher–child relationships and the classroom emotional context are linked in important ways to children's development, it is increasingly important to consider both components of children's experiences in the classroom. From a systems perspective, the overall emotional sensitivity of the classroom can be considered the context in which individual relationships develop. The dataset used in this study provided the opportunity to evaluate hypotheses regarding how teacher–child relationships and classroom emotional climate, measured in terms of the sensitivity and responsiveness of the classroom

emotional context, work in conjunction with one another. As a dataset from a large, nationally representative study, we were able to explore teacher–child relationships and classroom emotional contexts for a population diverse in socioeconomic status and ethnic and racial composition.

In general, three patterns emerged in our results and are discussed in detail in the following sections. First, regarding Aim 1, we find that preschool teachers' reports of their relationships with individual children were significantly associated with children's outcomes (both in preschool and the following year) whereas the classroom emotional context was not. Second, there are some indications that teacher–child relationships moderate associations between the classroom emotional context and children's outcomes, as investigated in Aim 2. Third, we generally find a stronger and more consistent link between teacher–child relationship quality and children's classroom behavior than their early academic skills, even after implementing analytic strategies to reduce mono-reporter bias.

Teacher–Child Relationships and Classroom Emotional Context

In the current study, teacher–child relationships referred to the teachers' perceptions of their sustained patterns of interaction and affective connections with individual children. The classroom emotional context comprised a classroom level measure of the sensitivity and responsiveness in the moment-to-moment behaviors and communicative exchanges that occur between teachers and children. According to the developmental systems framework guiding this study, relationships are the development-driving *process* occurring in the *context* of overall classroom level emotional sensitivity (Bronfenbrenner and Morris 2006; Pianta et al. 2003). From this perspective, we expected the more proximal (i.e., individual) relationships to have the strongest association with children's outcomes, but also that both "levels" of teacher–child dynamics would be important contributors to children's development and learning. Our results generally concur with those reporting that individual teacher–child relationships were more predictive of child outcomes than overall classroom climate (Cadima et al. 2015; Graves and Howes 2011; Jeon et al. 2010). We did, however, find limited indications that classroom emotional context may matter for children's behavior when children do not experience positive individual relationships with their classroom teacher.

Our findings are somewhat in contrast to recent studies measuring emotional quality of teacher–child interactions using the Classroom Assessment Scoring System (CLASS; Pianta et al. 2008). Many of these studies find it to be predictive of children's behavior (e.g., Burchinal et al. 2010; Curby et al. 2009a). Analysis on the factor structure of the CIS has found limited variability in CIS scores, suggesting that most caregivers were demonstrating similar sensitive behaviors (Colwell et al. 2013), and thus the differences in our findings from those using newer measures may reflect that the CIS does not distinguish classrooms that are "moderately" versus "highly" sensitive. Future work should examine whether (and how) different domains of teacher–child interactions relate to development across multiple domains.

Nevertheless, findings in the current study align with an emerging literature suggesting that relationships and classroom context are differentially associated with children's outcomes (Cadima et al. 2015; Graves and Howes 2011; Jeon et al. 2010), and these differences may be related to the constructs themselves, measurement at the group (classroom) level versus individual child level, or the method of measurement. The difference may be the constructs themselves, as the consistency of moment-to-moment interactions required to cultivate on-going individual relationships may require different skills than those

required to maintain an overall calm and positive tone in the classroom or to organize the daily schedule and activities. Some teachers may struggle to build relationships with either quieter children or more rambunctious children. Others may find that they are particularly skilled at building positive teacher–child relationships and responding to the unique needs of individual children, but struggle with managing the behavior and activities of the large group, as is necessary for high quality classroom interactions. These nuances are lost if multiple aspects of interpersonal dynamics are not assessed. If there are important differences between the skills needed for developing one-on-one relationships and maintaining emotionally supportive classroom contexts, then a focus on sets of skills is important for teacher professional development to enhance the quality of early childhood education.

Differences may be related to measurement at the group level versus the individual level. If the difference in associations with children's outcomes is related to viewing classrooms from the group level versus the individual child, then it is important to consider the research questions being asked and whether differences in individual experiences are systematic. Where systematic differences exist (e.g., children who speak a home language other than English are having less beneficial experiences, children with a particular temperament are benefitting more from either higher quality classroom interactions or positive relationships) there is opportunity for targeted professional development and intervention.

It is also possible that the difference between relationships and overall classroom context is really about the perceptions of the classroom teacher in comparison to what is visible to outside observations. If so, then additional measures using different methods are needed to capture a more comprehensive picture of children's classroom experiences. Teacher reports have the advantage of taking into consideration a greater period of time than isolated observations. However, the use of teacher reports on their relationships with children and on children's outcomes increases the risk of mono-reporter/mono-method bias. This potential bias is addressed when outside observers' perspectives are included in the data collection. In the current study, we attempted to address this concern by examining teachers' reports of children's behavior from two different classroom teachers, one year apart in time.

For researchers, another central question regarding classroom interactions and individual relationships is whether they are both necessary for understanding influences on children's learning and development. Data collection involving observed interactions in classrooms can be time consuming, expensive, and taxing on classroom teachers. If both teacher report of relationships and observations of classroom interactions provide similar information, researchers might consider choosing one method/focus over another. However, findings from this study suggest that this is not the case, and that teacher–child relationships and classroom interactions provide unique contributions to understanding children's experience in early childhood classrooms.

In the current study, we find some initial indication that teacher–child relationships and classroom emotional contexts may interrelate in important ways that impact our understanding of how either is associated with children's outcomes. In particular, our findings that the associations between classroom emotional context and children's outcomes are moderated by teacher–child relationships suggest that positive teacher–child relationships can, to some extent, compensate where classroom emotional sensitivity is lacking. Taken together, our findings suggest that the associations among teacher–child relationships and preschool classroom contexts and individual children's learning and development are more complex than research designs to this point have addressed.

Children's Academic Skills and Classroom Behavior

Though not one of our initial research questions, a clear pattern emerged suggesting a stronger link between teacher–child relationships and children's classroom behaviors than their academic outcomes. Given that teachers were the ones reporting on the relationship and rating children's behaviors, the potential for common method bias cannot be discounted and it should be noted that both of these measures rely on the teachers' perception. Teachers may report better relationships with children they consider to have less problematic behavior, or they may provide more favorable ratings for (or have more positive perceptions of) children with whom they have a close or affectionate relationship. The current data do not allow us to disentangle the processes underlying the associations; however, we employed two strategies within our analyses to address this concern. The regressions include a control for children's temperament at age 2, as rated by trained research staff. In addition, we examine whether teacher–child relationships during the preschool year predicts children's behavior a year later as rated by a different teacher, and indeed, we find that it does. Others have suggested that early teacher–child relationships set children up for a pattern of interacting in the classroom (Ladd and Burgess 1999) and this type of pattern may be more strongly reflected in children's classroom social and learning behaviors than in their actual academic accomplishments. This set of findings is consistent with Burchinal et al. (2011) meta-analysis of research on classroom quality, which concludes that associations with child development are stronger when dimensions of quality align with the outcome being examined.

Limitations and Future Research

The current findings must be considered in light of this study's limitations. One such limitation is the fact that the measures used here focus almost exclusively on the affective nature of what is occurring in the classroom. We are unable to examine how other aspects of interactions, such as instructional quality, are related to children's outcomes. Though data is currently being collected in a number of large studies that include observational measures of quality of classroom instructional interactions, we are unaware of any that are also collecting detailed information about individual relationships. Future research should test the hypotheses presented here with more multidimensional measures of classroom interactions. A richer understanding of individual teacher–child relationships would also be useful. It would be particularly helpful, for example, to know not only how close teachers feel to children, but also how well they feel like they know individual children and can teach effectively to their learning style. Examining both closeness and conflict and possible characteristics of children and teachers related to conflict may be an important area of future research given the associations between conflict and child outcomes across preschool and the following year. In future research, qualitative methods including observation and interview could also provide richer data on interpersonal dynamics within classrooms.

A second limitation, as mentioned above, is our inability with the current data to extract the constructs of relationships and interactions from their measurement methods. Future research using observational methods to measure interactions both at the group and individual level could provide some clarity here. It is also important to note that our teacher-report measure of teacher–child relationships in this data is not ideal given that it was comprised of only five items. Internal reliability for the conflict items was reasonable, but

quite low for the two items tapping closeness. We suspect that measures with more robust psychometrics could reveal even stronger associations between teacher–child relationships and child outcomes. An additional limitation, given the eligibility criteria for inclusion in the childcare observation substudy and our focus on center-based programs, is that our findings may not pertain to children in fewer than 10 h per week in any one care arrangement, those whose providers do not speak English or Spanish, and/or those in home-based child care settings.

Implications for Policy and Practice

Though several limitations in the current study have been acknowledged, the study addresses weaknesses in previous studies by implementing analytic strategies to address mono-reporter bias and by considering the impact of teacher–child relationships and classroom emotional context on both academic and social/emotional child outcomes both concurrently and across time. Further, the current study moves the field forward in understanding teacher–child relationships and classroom interactions in two ways. First, our findings re-emphasize the importance of teacher–child relationships, which must not be lost in the current focus on improving the quality of overall classroom interactions. Second, our findings indicate that teacher–child relationships and classroom emotional context work in conjunction to influence children's outcomes in complex ways and, if studied together, information gathered about children's experiences in classrooms can be optimized.

The current study offers important implications for practice, with findings that re-emphasize the importance of relationships in early childhood classrooms. Building relationships with young children takes certain skills and teacher development programs must be attentive to this. Preliminary work in teacher professional development regarding classroom relationship-building skills indicates positive potential (Driscoll et al. 2011; Helker and Ray 2009). Intervention work by Helker and Ray (2009) showed that relationship training increased the use of relationship-building techniques by teachers and decreased externalizing behavior by targeted students for those classrooms. Driscoll et al. (2011) found teachers' engagement in professional development to improve one-on-one teacher–child interactions improved teacher reported closeness in the relationship and children's social competence.

Conclusions

In recent years, tremendous gains have been made in the field of early childhood in terms of understanding the role of teacher–child relationships and classrooms contexts. Our findings add to the work suggesting positive, supportive teacher–child relationships have been shown to support children's cognitive, social and emotional development (Baker et al. 2008; Hamre and Pianta 2001; IOM and NRC 2015; NICHD 2005; Vitiello et al. 2012). Recent measures that capture a broader range of classroom interactions have expanded the notion of process quality in the field. However, both relationships and interactions between teachers and children in the classroom are complex. Teacher–child dyadic relationships occur within a system of relationships. Several important questions remain unanswered— To what extent do classroom level measures of interactions provide information about individual experiences? How might individual experiences vary based on characteristics of

the child or teachers and specific characteristics of the dyad? How do daily interactions shape relationships and vice versa? Limited data are available to address these questions. The current study contributes to this discussion with both teacher–child relationship data and data on classroom level interactions for a population-based sample of children and has provided support to the importance of individual teacher–child relationships on children's outcomes and has identified relationships as a moderator of classroom interactions.

Compliance with Ethical Standards

Conflict of interest The first, third, and fourth authors declare that they have no conflict of interest. The second author acknowledges that she is a co-author of one of the discussed measures.

Human and Animal Rights This article does not contain any studies with human participants or animals performed by any of the authors.

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