

Teacher-Child Relationships and Child Temperament in Early Achievement

Ashleigh Collins¹ & Erin O'Connor¹

¹ Department of Teaching and Learning, New York University, New York, USA

Correspondence: Ashleigh Collins, Department of Teaching and Learning, New York University, New York, USA. E-mail: ajc466@nyu.edu

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Abstract

Teacher-child relationship quality and child temperament have been associated with children's school adjustment and academic performance. However, few studies explore the influence of both child temperament and teacher-child relationship quality on children's academic development. This study investigates the role of teacher-child relationships on kindergarten children's temperament and academic performance. Study participants were comprised of 324 kindergarten students, attending 22 schools in urban, low-income communities. A multivariate regression analysis was used to explore whether teacher-child relationships moderate or mediate the association between child temperament and academic performance. The study reinforces previous findings that conflictual teacher-child relationships inhibit children's academic performance and close teacher-child relationships promote children's academic performance. For cautious children, close teacher-child relationships moderate mathematics performance. For high maintenance children, conflictual teacher-child mediate children's critical thinking. The findings have implications for teacher training, on-going teacher development, and the promotion of early academic development for children at-risk for underachievement.

Keywords: temperament, teacher-child relationships, kindergarten, children in low-income communities, low-income urban children

1. Introduction

Teacher-child relationship quality has long been associated with children's academic development (e.g., Hamre & Pianta, 2001; Pianta, 1999; Birch & Ladd, 1997). High quality teacher-child relationships, characterized by teacher responsiveness, low conflict, and high closeness, positively predict children's school adjustment, class participation, and academic development (Rudasill & Rimm-Kaufman, 2009; Ladd et al., 1999; Howes & Smith, 1995; Pianta & Niemtz, 1991). In contrast, low quality teacher-child relationships marked by teacher unresponsiveness, conflict, and low closeness, negatively predict children's effective schoolwork habits, class participation, and academic development (Pianta & Stuhlman, 2004; Hamre & Pianta, 2001; Ladd et al., 1999).

Child temperament has the potential to shape teacher-child relationship quality (Hughes, Luo, Kwok, & Lloyd, 2008). Children with high positive emotionality or effortful control (an aspect of task persistence dealing with children's attention abilities) are more likely to have close, less conflictual teacher-child relationships (Valiente, Swanson, & Eisenberg, 2012; Rudasill & Rimm-Kaufman, 2009; Rydell et al., 2005; Spinrad et al., 2004; Rubin, Burgess, & Coplan, 2002). Children with high withdrawal, high negative reactivity, or low effortful control are more likely to have distant, overly dependent, or conflictual teacher-child relationships (Rudasill, Niehaus, Buhs, & White, 2013; Valiente, Swanson, & Eisenberg, 2012; Thiji & Koomen, 2009; Rudasill, Rimm-Kaufman, Justice, & Pernce, 2006; Ladd & Burgess, 1999).

Although associations between teacher-child relationships, child temperament, and children's academic development have been identified (e.g., Rudasill & Rimm-Kaufman, 2009; Hamre & Pianta, 2005), it is not understood whether teacher-child relationships moderate or mediate associations between children's temperament and early academic development. Both high and low quality teacher-child relationships have proven to moderate the association between children's academic risk and early achievement (Hamre & Pianta,

2005; Ladd & Burgess, 2001). Teacher-child relationships have also proven to partially mediate the association between children's behavior and academic achievement (Stipek & Miles, 2008).

During kindergarten, teacher/child relationship quality is particularly important. The quality and affiliated outcomes of kindergarten children's teacher-child relationships reappears in subsequent grade levels (O'Connor & McCartney, 2006; Hamre & Pianta, 2005; Ladd & Burgess, 1999). Kindergarten children with low quality teacher-child relationships, for example, not only tend to have future low quality relationships, but also future school avoidance, lower academic achievement, and long-term school maladjustment (Mantzicopoulos, 2005; Pianta, La Paro, Payne, Cox, & Bradley, 2002; Hamre & Pianta, 2001; Birch & Ladd, 1997).

Additionally, children's minority and socio-economic status have been associated with the quality of teacher-child relationships (Buyse, Verschueren, Doumen, Van Damme, & Maes, 2008; Ladd, Birch, & Buhs, 1999). Non-minority children from socio-economically advantaged backgrounds tend to have more positive, close, and less conflictual teacher relationships than their minority, socio-economically disadvantaged peers (Buyse, Verschueren, Doumen, Van Damme, & Maes, 2008; Murray, Murray, & Waas, 2008; Mantzicopoulos, 2005; Saft & Pianta, 2001; Ladd, Birch, & Buhs, 1999). By the close of kindergarten, the academic differences between children with high and low quality teacher-child relationships have resulted in an academic achievement gap that widens with each successive grade level (Hamre & Pianta, 2005; Pianta & Stuhlman, 2004; Ladd, Birch, & Buhs, 1999).

The present study will consider the role of teacher-child relationship quality on the association between child temperament and achievement of kindergarten children attending urban schools in high poverty neighborhoods. Examining additional factors that may affect early achievement can inform early school supports for high quality teacher-child relationships and children's enduring academic development (Rudasill & Rimm-Kaufman, 2009; Ladd et al., 1999).

2. Literature Review

2.1 Child Temperament

The associations between child temperament and academic outcomes are stronger in early schooling than the associations between children's cognitive aptitude and academic outcomes (Entwistle, Alexander, & Olson, 2005; Coplan, Barber, & Lagacé-Séguin, 1999; Mevarech, 1985). Child temperament refers to the "constitutionally based individual differences in reactivity and self-regulation demonstrated across settings and circumstances" (Zentner & Shiner, 2012). In studies of school-age children, four temperament dimensions are consistently mentioned: negative reactivity, withdrawal, activity, and task persistence (Lyons-Thomas & McClowry, 2012; McClowry, 1995; Rothbart & Bates, 1998; Martin, Wisenbaker, & Huttenen, 1994; Martin, 1994).

Children high in negative reactivity are significantly and negatively affected by environmental change and unfavorable circumstances (McClowry, 2003). High levels of negative reactivity can impede children's in-class attention, motivation, recall, and cooperation (Pekrun et al., 2009; Schultz et al., 2009; Perbandt, 2007; Granziano et al., 2007; Gilliom et al., 2002). Accordingly, students high in negative reactivity have difficulty acquiring early academic skills and are at risk for low academic achievement (Denham et al., 2012; Newman et al., 1998). Children low in negative reactivity are more likely to tackle challenging academic tasks, maintain engagement, and achieve at high academic levels (Putnam, 2012).

Children high in withdrawal are commonly referred to as shy and are reluctant to participate in new interpersonal or environmental situations (Neal & Edelman, 2003; Achenbach & Edelbrock, 1981). Their reluctance is associated with decreased academic motivation, higher school absences, and lower academic development, particularly during the kindergarten year (Valiente, Lemery-Chalfant, & Swanson, 2010; Gilman & Anderman, 2006; Davidson et al., 2000; Furnham & Mitchell, 1991). Conversely, children low in withdrawal willingly approach new situations (including new academic endeavors and interpersonal interactions) and are more likely to achieve at high levels across subjects (Valiente, Swanson, & Eisenberg, 2012; Walker & Henderson, 2012; Valiente, Lemery-Chalfant, & Swanson, 2010; Spere & Evans, 2009; Furnham & Mitchell, 1991).

Children high in activity tend to be in constant motion and have difficulty remaining stationary in the classroom (Strelau & Zawadzki, 2012; Rothbart & Jones, 1998; Martin & Holbrook, 1985). For school-age children, high activity levels are associated with lower development and greater risk for learning difficulties than children low in activity (Schaughency & Fagot, 1993; Palisin, 1986; Martin & Holbrook, 1985). Nonetheless, high levels of activity in preschool-age children have been associated with high cognitive ability and later school achievement (Rudasill et al., 2010; DiLalla et al., 1990). High activity levels in preschool may suggest high child intellectual

curiosity that develops into instructional engagement as the child ages (Rudasill, Gallagher, & White, 2010; Rudasill et al., 2010; DiLalla et al., 1990).

Children high in task persistence maintain sustained attention on a given task. In the classroom, their attentiveness results in complete school assignments, maintenance of behavioral expectations, and high academic competence (Trentacosta & Izard, 2007; Rothbart & Bates, 2006; Bramlett, Scott, & Rowell, 2000; Martin & Holbrook, 1985). Low task persistent children have difficulty attending to tasks for an extended time, which can result in low academic development (Arnold et al., 2012; McClelland et al., 2013; Rabiner et al., 2004).

2.2 Child Temperament Profiles

Many temperament researchers examine associations between dimensions of child temperament and child outcomes (e.g., Lengua et al., 2008; Trentacosta & Izard, 2007; Li-Grining et al., 2006). An infrequently used method is considering how reoccurring composites of temperament dimensions, known as temperament profiles, influence child outcomes (Zentner & Shiner, 2012; De Pauw & Mervielde, 2010). One reason for the use of temperament profiles is because children's temperament tends to occur in combinations of varying levels of temperament dimensions (Zentner & Bates, 2008). As a result, the use of temperament profiles offers a more complete depiction of the potential relationship between children's temperament and academic development (De Pauw, Mervielde, & Leeuwen, 2009; Rothbart, Ahadi, & Evans, 2000).

Temperament profiles are derived by using variations of factor analysis to identify patterns of temperament dimension or combinations among temperament the dimension (Rettew et al., 2010; Caspi & Silva, 1995). Once patterns are identified, they are then compared and best-fit temperament profiles are created (Rettew et al., 2010). Since temperament profiles are derived from frequently occurring temperament dimensions, profiles are often generalizable across study samples, analytical approaches, and temperament scales (Janson & Mathieson, 2008).

In their New York Longitudinal Study, seminal temperament researchers Thomas, Chess, and Birch (1968) identified three temperament profiles: "easy", "difficult", and "slow-to-warm up". "Easy" profile children are high in approach, adaptation, and positive emotionality (Thomas & Chess, 1977; Thomas, Chess, & Birch, 1968). The positive emotionality and high approach of "easy" temperaments lend themselves to high-quality teacher-child relationships (Valiente, Swanson, & Eisenberg, 2012; Walker & Henderson, 2012; Rudasill & Rimm-Kaufman, 2009; Rudasill & Rimm-Kaufman, 2008; Eisenberg et al., 2004). Conversely, "difficult" profile children are high in withdrawal, slow in adaptation, and high in negative emotionality (Thomas & Chess, 1977; Thomas, Chess, & Birch, 1968). While "Slow-to-warm up" children are considered temperamentally "difficult", they are known for high levels of withdrawal and slow acclimation to new situational and interpersonal encounters (Thomas & Chess, 1977).

McClowry (2002) identified the temperament profiles of school-age children: high maintenance, industrious, cautious/slow-to-warm up, and social/eager-to-try. The high maintenance temperament profile is high in negative reactivity, high in activity, and low in task persistence. Conversely, the industrious profile exhibits low negative reactivity, low activity, and high task persistence. The cautious/slow-to-warm up profile is high in withdrawal, and its converse, the social/eager-to-try profile is low in withdrawal. Given the comprising temperament dimensions, the high maintenance and cautious/slow-to-warm child profiles are considered "challenging" profiles (McClowry, 2002a). Industrious and social/eager-to-try child profiles are often perceived as "easy" temperaments.

2.3 Child Temperament and Teacher-Child Relationships

Whether of an "easy" or "challenging" profile, children's temperament appears to influence the quality of teacher-child relationships. Children high in withdrawal, for example, are less likely to have close teacher-child relationships compared to children high in approach (Rudasill & Rimm-Kaufman, 2009; Rydell et al., 2005). Both children with high negative reactivity and children low in effortful control tend to have less close, conflictual teacher-child relationships (Valiente et al., 2012; Rudasill & Rimm-Kaufman, 2009; Rydell et al., 2005). Conversely, children high in effortful control are likely to have close, less conflictual teacher-child relationships (Silva et al., 2012; Rudasill & Rimm-Kaufman, 2009; Eisenhower et al., 2007). Children high in positive emotionality have a greater likelihood of forming positive peer and teacher relationships, and in turn, they are more likely to garner the academic support present in high achieving students (Valiente, Swanson, & Eisenberg, 2012; Spinrad et al., 2004; Rubin, Burgess, & Coplan, 2002; Saarni et al., 1998). Such associations suggest that teacher-child relationships may serve as mechanisms through which child temperament influences child achievement.

Despite a suggested influence of child temperament on teacher-child relationship quality (Rudasill & Rimm-Kaufman, 2009; Teglasi, 1998), the nature of the interaction between children's temperament and teacher-child relationships on academic skill development is unclear. On one hand, child temperament seems to influence the quality of the teacher-child relationships (Rudasill, Gallagher, & White, 2010; Rudasill & Rimm-Kaufman, 2009; Hughes, Luo, Kwok, & Loyd, 2008; Teglasi, 1998). Generally, children with "easy" temperaments have high-quality teacher-child relationships, and those with "difficult" temperaments have low quality teacher-child relationships (McClowry, Rodriguez, Tamis-LeMonda, Spellmann, Carlson, & Snow, 2013; Rudasill, Niehaus, Buhs, & White, 2013; Curby et al., 2011; Rudasill & Rimm-Kaufman, 2009; Ladd & Burgess, 1999). Among the "difficult" temperament profiles, cautious/slow-to-warm children are at particular risk for low quality relationships. Cautious children have high levels of teacher-child conflict, high child dependency, and low teacher-child closeness compared to other child temperament profiles (Curby, Rudasill, Edwards, & Pérez-Edgar, 2011; Rydell, Bohlin, & Thorell, 2005; Rudasill & Rimm-Kaufman, 2009). Teachers are also less likely to engage in high-quality interactions with children of cautious temperament profiles (Rudasill, 2011; Rydell, Bohlin, & Thorell, 2005; Kagan et al., 1988).

Another group of children, known as social/eager-to-try, have temperaments that are low in withdrawal. For social/eager-to-try children, there are mixed outcomes in teacher-child relationship quality according to the level of a child's task persistence (Graziano, Reavis, Keane, & Calkins, 2007; Aksan et al., 1999; Caspi & Silva, 1995). Social children, who are low in task persistence, have low quality teacher-child relationships, characterized by high conflict and infrequent teacher interactions (Rudasill, 2011; Rudasill & Rimm-Kaufman, 2008; Rudasill, Rimm-Kaufman, Justice, & Pence, 2006; Coplan & Prakesh, 2003). Social children, who are high in task persistence, have high quality teacher-child relationships, characterized by high teacher-child closeness and more frequent teacher interactions (Rudasill, 2011; Rudasill & Rimm-Kaufman, 2008; Rudasill, Rimm-Kaufman, Justice, & Pence, 2006; Coplan & Prakesh, 2003).

The tendency of particular child temperaments to result in high- or low- quality teacher-child relationships may be less a reflection of individual child characteristics and more a reflection of the goodness of fit between children's temperament and their environment (Chess & Thomas, 1999; Lerner, 1983). Thus, alongside studies, for example, finding "easy" child temperaments (high in effortful control and positive emotionality) seemingly predisposed toward high quality teacher-child relationships (Valiente, Swanson, & Eisenberg, 2012; Silva et al., 2012; Rudasill & Rimm-Kaufman, 2009; Eisenhower et al., 2007), studies also find that the same children are viewed by their teachers as more "teachable" (Thomas, 2003; Blair, 2002; Bramlett, Scott, & Rowell, 2000; Guerin et al., 2000). Such a perspective may create a classroom dynamic where teachers are more in tuned and responsive to temperamentally "easy" students (Curby et al., 2011; Baker, 2006).

On the other hand, teacher-child relationship quality seems to influence the dynamic between kindergarten children's temperament and academic development, particularly for children at temperamental and environmental (i.e., socio-emotional and community) risk of underachievement (Valiente et al., 2008; O'Connor & McCartney, 2007). With kindergarten teacher-child relationships predicting children's future academic development (Baker, 2006; Silver et al., 2005; Pianta & Stuhlman, 2004; Hamre & Pianta, 2001), the quality of those early teacher-child interactions is critical and even more so for kindergarten children attending urban schools in high poverty neighborhoods (Hamre & Pianta, 2005; Burchinal et al., 1995; Baydar & Brooks-Gunn, 1991). Kindergarten children repeatedly exposed to the stressors of urban, high poverty living (including financial difficulty, chronic community violence, failing schools) can experience an impaired ability to learn new academic concepts and develop a positive school perception (Burke et al., 2011; Chartier, Walker, & Naimark, 2010; Evans & Schamberg, 2009; Noguera, 2008, 2003). They are also at increased risk for low quality teacher-child relationships (Murray, Murray, & Waas, 2008; Rimm-Kaufman, Voorhees, Snell, & La Paro, 2003). High quality teacher-child relationships not only promote high academic achievement overall (e.g., Deater-Deckard et al., 2011; Valiente et al., 2008; O'Connor & McCartney, 2007), but for children at risk for underachievement, high quality teacher-child relationships can also promote academic achievement that is on par with children at low academic risk (O'Connor & McCartney, 2007; Hamre & Pianta, 2005).

Teachers' awareness and responsiveness to children's needs have proven particularly effective for children of "difficult" temperaments, at risk for low academic achievement (Curby et al., 2011; Liew, Chen, & Hughes, 2009; Valiente et al., 2008; Gazelle, 2006). In high quality teacher-child relationships, teachers are emotionally responsive to student needs, scaffolding their instruction and effectively using questioning to maximize student learning (O'Connor, Dearing, & Collins, 2011; Bohn, Roehrig, & Pressley, 2004; Pianta et al., 2002; Guthrie, 2000; Meyer, Wardrop, Hastings, & Linn, 1993). As a result, children in high quality teacher-child relationships

are better equipped to adjust to school, engage in academic content, and attain early elementary academic gains in both reading and math (Rudasill, Gallagher, & White, 2010; Rimm-Kaufman & Chiu, 2007; Perry, Donohue, & Weinstein, 2007; Howes et al., 2000; Howes & Smith, 1995; Pederson, Faucher, & Eaton, 1978). The open communication present in positive teacher-child relationships is inversely related to child anxiety (Pianta & Steinberg, 1992), and the teacher sensitivity present is associated increased self-reliance and decreased negative, off-task behaviors for with socially bold children (Rimm-Kaufman et al., 2002). Consequently, teacher-child relationships may contribute to the building of child resiliency and serve as a protective factor for children at risk for underachievement (Hamre & Pianta, 2005; Noam, Warner, & Van Dyken, 2001; Lynch & Cicchetti, 1992).

2.4 Current Study

This study will explore associations between child temperament, teacher-child relationship quality, and children's academic development. The existent research has considered the role of teacher-child relationship quality on children's academic development (e.g., Burchinal, Peisner-Feinberg, Pianta, & Howes, 2002; Ladd, Birch, & Buhs, 1999; Pianta & Steinberg, 1992), and to a limited extent, it has considered the role of child temperament on children's achievement (Rudasill, Niehaus, Buhs, & White, 2013; Valiente, Swanson, & Eisenberg, 2012). The current study will parse apart the nature of the dynamic between the three—child temperament, teacher-child relationships, and children's academic development. It will examine these elements within a population at risk for both low quality teacher-child relationships and low achievement—kindergarten children attending urban schools in high poverty neighborhoods (Murray, Murray, & Waas, 2008; Rimm-Kaufman, Voorhees, Snell, & La Paro, 2003). Additionally, it will offer a comprehensive perspective of the potential nexus, by considering three different data sources: standardized achievement measures, parent-reported child temperament, and teacher-reported child measures. The triangulated data offers an authentic depiction of children's in-class academic functioning (Blair, 2002), bridges children's major sources of development—home and school (Wills, Blechman, & McNamara, 1996; Sroufe, 1995)—and offers a common evaluative tool to compare the present study participants with previous research (Arnold et al., 2012; Crosnoe et al., 2010; McClelland et al., 2006; Alexander et al., 1988). The study will specifically explore the following questions:

- 1) What is the role of teacher-child relationships in children's reading and math skill development among low-income, urban children's reading and math skills in kindergarten?
- 2) Do teacher-child relationships moderate the associations between child temperament and low-income, urban children's reading and math skills in kindergarten?
- 3) Do teacher-child relationships mediate the associations between child temperament and low-income, urban children's reading and math skills in kindergarten?

3. Method

3.1 Participants

The sample included 324 students in 120 classrooms within twenty-two underserved, urban elementary schools. The students ranged in age from four to seven ($M = 5.38$ years, $SD = 0.61$ years). Forty-eight percent of the students were female, and fifty-two percent of the students were male. The majority of the students were African-American ($M = 79.13\%$) or Latino ($M = 44.21\%$), and they qualified for free or reduced lunch ($M = 79.97\%$). Participating teachers were predominately African-American (56.4% African-American) and female (94.2%).

The study data is derived from a longitudinal intervention study evaluating the efficacy of the temperament-based intervention, *INSIGHTS into Children's Temperament* (McClowry, O'Connor, & Cappella, 2008-2012). Data was collected over a span of three school years (2009-2012). This study uses only baseline kindergarten data collected across the three academic years.

3.2 Measures

3.2.1 Child Temperament

The School-Aged Temperament Inventory was used to assess child temperament (SATI; McClowry, 2002). The SATI is comprised of 38 items. Children's temperament was categorized by parent report on a five-point, Likert-response scale (ranging from 1 = never, 3 = sometimes, and 5 = always). The SATI was standardized using a nationally diverse sample ($N = 883$ parents) to identify children's levels of: withdrawal, task persistence,

negative reactivity, and activity. The Cronbach's alphas for the SATI in this study included: activity, $\alpha = 0.77$; withdrawal, $\alpha = 0.81$; task persistence, $\alpha = 0.7$; negative reactivity, $\alpha = 0.87$.

3.2.2 Teacher-Child Relationship Quality

The Student-Teacher Relationship Scale is a 15-item scale assessing the quality of teacher/child relationships (STRS; Pianta, 1992). Teachers reported on the level of closeness and conflict between themselves and their students using a five-point, Likert-scale (ranging from 1 = definitely does not apply to 5 = definitely applies) (Pianta, 2001). The eight-item closeness subscale focused on the level of warmth and communication between teacher and student. The seven-item conflict subscale focused on the degree to which the teacher-child relationship was comprised of antagonism and dissension. Cronbach's alphas for closeness and conflict ranged from .92 to .87, respectively (Hamre & Pianta, 2001).

3.2.3 Woodcock-Johnson III Tests

Children's math and reading development was assessed using the Woodcock-Johnson Applied Problems and Woodcock-Johnson Letter-Word, respectively (Woodcock, McGrew, & Mather, 2001). The 39-item, Applied Problems subtest measures children's quantitative reasoning, math knowledge (Wendling, Schrank, & Schmitt, 2007). Applied Problems has a reliability of 0.93 (SE = 4.08). The 76-item, Letter-Word Identification subtest measures children's reading decoding and has a reliability of 0.94 (SE = 3.81).

3.2.4 Academic Competency Evaluation Scales (ACES)

The overall academic functioning of children was assessed using the Academic Competency Evaluation Scales (ACES; DiPerna, & Elliott, 1999, 2000). ACES measured children's reading/language arts, mathematics, and critical thinking skills (DiPerna & Elliott, 2000, 2002). The Mathematics subscale is comprised of eight items. The Reading/Language Arts subscale included eleven items, and the Critical Thinking scale included nine items. For all scales, teachers rate student academic competence on a five-point, Likert scale, where 1 = far below, 3 = grade level, and 5 = far above. There was an internal consistency of $\alpha = 0.98$ and test-retest stability of $r = 0.92$ (DiPerna & Elliott, 1999). Correlational validity for ACES ranges from 0.16 to 0.75 with student grades and standardized test performance (DiPerna & Elliott, 2000).

3.3 Procedure

A variety of methods were used to recruit participant teachers and kindergarten families, including: letters, fliers, telephone calls, and brief parent meeting presentations. Following parent consent and child assent, teachers completed several questionnaire in relation to each child Student-Teacher Relationship Scale (Pianta, 2001) and Academic Competency Evaluation Scale (DiPerna & Elliott, 1999). External, trained observers administered the Woodcock-Johnson Applied Problems and Woodcock-Johnson Letter-Word subtests. Parents completed the School-Aged Temperament Inventory (McClowry, 1995).

3.4 Analytic Strategy

The relationship between children's temperament, child academic skills, and teacher-child relationship quality was explored using a multivariate regression analysis. A correlation matrix was first created to examine associations between temperament variables, child demographics and student/teacher relationships to test for multicollinearity. Then child gender and parental education were entered as control variables in a regression model predicting children's academic skills. To determine whether teacher-child relationship quality moderates the relationship between child temperament and child academic skills two-way interaction terms (each of the children's temperament profiles X both teacher-child relationship quality) were added to the model and their significance were tested. The two-way interaction terms were comprised of each of the child temperament profiles and the two subscales of teacher-child relationship quality, such that each temperament profile had one interaction term with student/teacher conflict and one with student/teacher closeness.

To test whether teacher-child relationships mediate the relationship between child temperament and child academic skills, two types of baseline models were built. One model included baseline control variables and child temperament predicting children's academic outcomes, and the second model added two teacher-child relationship quality variables (teacher-child conflict and closeness) to the previous model. If a decrease in temperament profile coefficients occurred from the first to the second model a mediation of child temperament through teacher-child relationship quality was noted, and a formal test of mediation using the Sobel's z-test was conducted.

Child temperament profiles were created by, first, ascertaining the level of intensity that children exhibited for each of the four temperament dimensions. Temperament dimension values falling below the mean were ascribed “low”. Temperament dimensions within the mean were ascribed “moderate”, and “high” was ascribed for temperament dimension levels above the mean. The industrious child profile was high in task persistence, low in activity, and low in negative reactivity. The high maintenance child profile was low in task persistence, high in activity, and high in negative reactivity. The cautious/slow-to-warm up profile was high in withdrawal, and the social/eager-to-try profile was low in withdrawal. Over eighty-nine percent (Mean = 89.6%) of the study sample (N = 275) qualified as one of the four temperament profiles. The greatest number of children qualified as either the social/eager-to-try profile (Mean = 39%) or the cautious/slow-to-warm up profile (Mean = 30%). Thirteen percent of the study population qualified as an industrious profile, and approximately eight percent qualified as a high maintenance profile (Mean = 7.6%).

3.4.1 Missing Data

Student absences, family travel, transiency, or occasional conflicts between the school calendar and research collection resulted in the random occurrence of randomly missing student data. Such an occurrence is common in school-based research (Puma et al., 2009). Since the data was missing at random and without systematic differences, listwise deletion was used. The final sample size was 275 following listwise deletion.

4. Results

4.1 What Is the Role of Teacher-Child Relationships in Children’s Reading and Math Skill Development?

Teacher-child relationship quality was influential in children’s academic development (See Tables 1, 2, 3, 4, and 5). Conflictual teacher-child relationships were both significantly and negatively impactful for children’s Woodcock-Johnson Letter Word ($b = -1.08$, $SE = 0.51$, $p \leq 0.05$), ACES Reading ($b = -0.10$, $SE = 0.05$, $p \leq 0.05$), ACES Math ($b = -0.11$, $SE = 0.04$, $p \leq 0.05$), and ACES Critical Thinking ($b = -0.11$, $SE = 0.04$, $p \leq 0.01$) scores. Close teacher-child relationships were positively associated with children’s Woodcock-Johnson Letter Word ($b = 1.14$, $SE = 0.69$, $p \leq 0.10$), Woodcock-Johnson Applied Problems ($b = 1.71$, $SE = 0.47$, $p \leq 0.01$), ACES Math ($b = 0.29$, $SE = 0.05$, $p \leq 0.01$), and ACES Critical Thinking ($b = 0.29$, $SE = 0.05$, $p \leq 0.01$) scores.

Table 1. Summary of regression for child temperament predicting Woodcock-Johnson letter word

Variable	Model 1			Model 2		
	B	SE B	β	B	SE B	B
Constant	15.68**	2.54		12.73**	3.83	
Child gender	-0.73	0.93	-0.05	-0.13	0.94	-0.01
Parent education	0.19	0.18	0.07	0.19	0.18	0.07
Cautious	-1.59	1.04	-0.1	-1.65	1.05	-0.1
High maintenance	-0.6	1.75	-0.02	-0.38	1.73	-0.01
Industrious	-0.45	1.38	-0.02	-0.6	1.37	-0.03
Student/Teacher Conflict				-1.08*	0.51	-0.14*
Student/Teacher Closeness				1.14†	0.69	0.11†
R ²		7.21			7.1	
F for change in R ²		0.97			4.45*	

Note. † = $p \leq .10$, * = $p \leq .05$, ** = $p \leq .01$.

Table 2. Summary of regression for child temperament predicting Woodcock-Johnson applied problems

Variable	Model 1		Model 2		
	B	SE B	B	SE B	B
Constant	11.09**	1.75	5.15*	0.05	
Child gender	-0.32	0.64	0.21	0.64	0.02
Parent education	0.31*	0.13	0.28	0.12	0.14
Cautious	-1.33 †	0.72	-1.16 †	0.71	-0.10 †
High maintenance	0.41	1.21	0.4	1.17	0.02
Industrious	0.35	0.95	0.22	0.92	0.01
Student/Teacher Conflict			-0.51	0.34	-0.10
Student/Teacher Closeness			1.71**	0.47	0.23**
R ²		0.05		0.12	
F for change in R ²		2.41*		9.12**	

Note. † = $p \leq .10$, * = $p \leq .05$, ** = $p \leq .01$.

Table 3. Summary of regression for child temperament predicting ACES reading

Variable	Model 1			Model 2		
	B	SE B	β	B	SE B	B
Constant	2.52**	0.24		1.32**	0.35	
Child gender	-0.14†	0.89	-0.10†	-0.03	0.08	-0.02
Parent education	0.23	0.02	0.83	0.02	0.02	0.06
Cautious	-0.26**	0.1	-0.17**	-0.22*	0.09	-0.14*
High maintenance	-0.12	0.17	-0.04	-0.12	0.16	-0.04
Industrious	0.09	0.13	0.02	0.09	0.12	0.05
Student/Teacher Conflict				-0.10*	0.05	-0.13*
Student/Teacher Closeness				0.35	0.06	0.34
R ²		0.06			0.2	
F for change in R ²		3.01**			21.77**	

Note. † = $p \leq .10$, * = $p \leq .05$, ** = $p \leq .01$.

Table 4. Summary of regression for child temperament predicting ACES math

Variable	Model 1			Model 2		
	B	SE B	β	B	SE B	B
Constant	2.64**	0.22		1.67**	0.31	
Child gender	-0.11	0.08	-0.08	-0.01	0.07	-0.01
Parent education	0.01	0.02	0.06	0.01	0.01	0.04
Cautious	-0.28*	0.09	-0.20*	-0.25*	0.08	-0.15*
High maintenance	0.02	0.152	0.01	0.031	0.14	0.01
Industrious	0.1	0.11	0.05	0.1	0.11	0.05
Student/Teacher Conflict				-0.11*	0.04	-0.16*
Student/Teacher Closeness				0.29**	0.05	0.31**
R ²		0.06			0.19	

F for change in R² 3.05* 20.63**

Note. † = p ≤ .10, * = p ≤ .05, ** = p ≤ .01.

Table 5. Summary of regression for child temperament predicting ACES critical thinking

Variable	Model 1			Model 2		
	B	SE B	β	B	SE B	B
Constant	2.46**	0.22		1.49**	0.31	
Child gender	-0.14†	0.08	-0.11†	-0.14†	0.08	-0.11†
Parent education	0.03†	0.015	0.12†	0.02†	0.01	0.10†
Cautious	-0.29**	0.09	-0.20**	-0.26*	0.08	-0.18*
High maintenance	0.005	0.15	0.02	0.06	0.14	0.02
Industrious	0.05	0.11	0.03	0.05	0.11	0.03
Student/Teacher Conflict				-0.11**	0.04	-0.16**
Student/Teacher Closeness				0.29**	0.05	0.32**
R ²		0.08			0.22	
F for change in R ²		4.09**			21.94**	

Note. † = p ≤ .10, * = p ≤ .05, ** = p ≤ .01.

4.2 Do Teacher-Child Relationship Quality Moderate the Associations between Child Temperament and Children's Reading and Math Skills in Kindergarten?

After conducting a correlation analysis of the temperament profile variables (Table 6), the social/eager-to-try profile was found significantly correlated to the high maintenance ($r = -0.119$, $p = 0.05$) and cautious/slow-to-warm up ($r = -0.53$, $p \leq 0.001$) profile. Given the high correlations, the social/eager-to-try profile was omitted from all subsequent the analyses and findings are in relation to the excluded social/eager-to-try profile.

In conducting a correlation analysis, omitting the social/eager-to-try profile, there were several additional significant correlations that surfaced. Student/teacher closeness was negatively associated with male students ($r = -0.17$, $p \leq 0.05$), the Cautious child temperament profile ($r = -0.14$, $p \leq 0.001$), and student/teacher conflict ($r = -0.27$, $p \leq 0.001$). It was positively associated with parental education ($r = 0.10$, $p \leq 0.10$). Student/teacher conflict was negatively associated with the Cautious child temperament profile ($r = -0.11$, $p \leq 0.10$) and student/teacher closeness ($r = -0.27$, $p \leq 0.001$). It was positively associated with the High maintenance child temperament profile ($r = 0.10$, $p \leq 0.10$) and male students ($r = 0.18$, $p \leq 0.001$).

Teacher-child relationship quality proved to have a statistically significant moderating affect on the association between children's temperament and children's academic development. Of all the interactions tested, only one was significant. Cautious children's Woodcock-Johnson Applied Problems scores were moderated by teacher-child closeness ($b = 1.76$, $SE = 0.90$, $p \leq 0.10$).

Table 6. Pearson's product moment correlations for child temperament and teacher-child relationships

	Child Temperament			Controls		Student/Teacher Relationships	
	High maintenance	Cautious	Industrious	Child Gender	Parent Education	Conflict	Closeness
Child Temperament							
High maintenance	1	0.8	-0.11†	0.91	0.33	0.10†	0.01
Cautious	0.08	1	-0.12*	-0.02	-0.18**	-0.11†	-0.14*
Industrious	-0.11†	-0.12*	1	-0.06	0.03	-0.05	0.01
Controls							
Child Gender	0.09	-0.02	-0.06	1	0.03	0.18**	-0.17**
Parent Education	0.03	-0.18**	0.03	0.03	1	0.06	0.10†
Student/Teacher Relationships							
Relationships	0.10†	-0.11†	-0.05	0.18**	0.06	1	-0.27**
Conflict							
Closeness	0.01	-0.14*	0.01	-0.17**	0.10†	-0.27**	1

Note. † = $p \leq .10$, * = $p \leq .05$, ** = $p \leq .01$, N = 275 for child temperament & gender. N = 262 for Student/Teacher Relationships.

Table 7. Cautious x student/teacher closeness predicting Woodcock-Johnson applied problems (N = 275)

Variable	Model 1			Model 2		
	B	SE B	β	B	SE B	B
Constant	3.95	2.46		6.50*	2.82	
Child gender	0.07	0.63	0.01	0.06	0.63	0.01
Parent education	0.26*	0.12	0.14*	0.24*	0.12	0.12*
Student/Teacher Closeness	1.84**	0.46	0.25**	1.28*	0.55	0.18*
Cautious	-1.01	0.7	-0.09	-8.08*	3.94	-0.73*
High maintenance	0.23	1.17	0.01	0.12	1.17	0.01
Industrious	0.27	0.92	0.02	0.32	0.92	0.02
Cautious x Student/Teacher Closeness				1.78†	0.98	0.64†
R ²		0.11			0.12	
F for change in R ²		4.80**			3.33†	

Note. † = $p \leq .10$, * = $p \leq .05$, ** = $p \leq .01$.

4.3 Do Teacher-Child Relationships Mediate the Associations between Child Temperament and Low-Income, Urban Children's Reading and Math Skills in Kindergarten?

The quality of teacher-child relationships does not seem to mediate the relationship between child temperament and children's academic progress. No mediate analyses proved statistically significant.

5. Discussion

In keeping with previous literature (Stipek & Miles, 2008; Baker, 2006; Pianta & Stuhlman, 2004; Birch & Ladd, 1997), this study found teacher-child conflict was negatively associated with kindergarten children's academic skills. Specifically, conflict negatively impacted kindergarten students' Woodcock-Johnson Letter Word, ACES Reading, ACES Math, and ACES Critical Thinking scores. Such outcomes are in keeping with existent research. Teacher-child relationships characterized by high teacher-child conflict predict low academic skill development for children (Pianta & Stuhlman, 2004; Hamre & Pianta, 2001; Birch & Ladd, 1997). It is unclear exactly which aspect of conflictual teacher-child relationships affects children's low achievement. However, children in highly

conflictual teacher-child relationships tend to have negative impressions about school, low levels of classroom cooperativeness, and low academic engagement (Stipek & Miles, 2008; Ladd, Birch, & Buhs, 1999; Birch & Ladd, 1997).

The study found that conflictual student/teacher relationships did not significantly influence children's Woodcock-Johnson Applied Problem scores. Interestingly enough, this finding is also in keeping with previous literature. While past research finds that teacher sensitivity, responsiveness, and closeness positively influence children's math skills (Peisner-Feinberg & Burchinal, 1997), teacher-child conflict is typically associated with children's teacher-reported academic scores, such as the ACES academic competency measure and children's grade point average (Valiente, Lemery-Chalfant, Swanson, & Reisner, 2008; Pianta & Stuhlman, 2004). Children's early math skills also tend to be associated with child IQ and temperament, particularly aspects of task persistence (Graziano, Reavis, Keane, & Calkins, 2007). It may be that the time, effort, and stress that teachers endure in conflictual relationships adversely affects teachers' evaluations of children's academic abilities.

Cautious children were found to be less likely to have conflictual relationships with teachers. This finding is inconsistent with previous research, which finds teachers' perceptions of temperamentally "challenging" child behavior, including cautious children, to be among the greatest predictors of teacher-child conflict (Rudasill, Niehaus, Buhs, & White, 2013; Hamre, Pianta, Downer, & Mashburn, 2008; Ladd et al., 1999). However, less conflict between teachers and cautious children may be more a byproduct of infrequent teacher-child relationships than the quality of the teacher-child relationship itself. Research shows that cautious children's reluctance to extend themselves in the classroom makes them easily overlooked by teachers (Rudasill & Rimm-Kaufman, 2009; Ladd et al., 1999; Martin, 1994). Accordingly, teachers tend to facilitate fewer teacher-child interactions and fewer opportunities for cautious children to participate in class (Rudasill, 2011; Rydell, Bohlin, & Thorell, 2005; Martin, 1994). While their quiet demeanor withdraws cautious children from the classroom conversation, it does not seem to invoke negative feelings by teachers, an occurrence associated with more frequent teacher-child interactions (Thijs, Koomen, & Van der Leij, 2008; Stuhlman & Pianta, 2001). Instead, teachers' relationships with cautious children are unlikely to be notable enough for teachers to rate them as particularly conflictual or close. Such a tendency may have resulted in the lowered incidence of teacher/conflict for cautious children in this study.

Aligned with previous literature (Maldonado-Carreño & Votruba-Drazal, 2011; Hamre & Pianta, 2005; Pianta & Stuhlman, 2004), this study found teacher-child closeness was positively associated with kindergarten academic skills. Close teacher-child relationships positively influenced both children's standardized performance (i.e., Woodcock-Johnson Letter-Word and Applied Problems) and teacher-reported competency measures, specifically including ACES Math and Critical Thinking scores. High closeness in teacher-child relationships is consistently associated with children's high academic performance (Hamre & Pianta, 2005, 2001; Birch & Ladd, 1997; Howes & Smith, 1995). In addition to positive teacher relationships, children in close teacher-child relationships have a greater likelihood of forming positive peer relationships (Valiente, Swanson, & Eisenberg, 2012; Spinrad et al., 2004; Rubin, Burgess, & Coplan, 2002; Saarni et al., 1998). Both of which enable children to garner the academic support present in high achieving (Valiente, Swanson, & Eisenberg, 2012; Spinrad et al., 2004; Rubin, Burgess, & Coplan, 2002; Saarni et al., 1998). In this study, teacher-child conflict partially mediated the association between cautious temperament and ACES Math and ACES Critical Thinking scores. Negative teacher-child relationships, characterized by teacher-child conflict, can intensify the negative academic outcomes for children at risk-for underachievement (Baydar & Brooks-Gunn, 1991; Burchinal et al., 1995). Cautious children are already predisposed toward low academic achievement (e.g., Valiente, Lemery-Chalfant, & Swanson, 2010; Gilman & Anderman, 2006). Teacher-child conflict is related to heightened student misbehavior, anti-school sentiments, and low academic skills (Hamre & Pianta, 2001; Birch & Ladd, 1997; Pianta & Steinberg, 1992). It all suggests that conflictual relationships are the conduit through which cautious children relate to their ACES Math and Critical Thinking skills.

Cautious child temperaments seem at greater risk for infrequent teacher-child interactions, yet such temperament profiles are also more susceptible to the affects of teacher-child relationship quality (Buyse, Verschueren, Doumen, Van Damme, & Maes, 2008; Hamre & Pianta, 2005; Pianta & Steinberg, 1992). In this study, teacher-child closeness appears to buffer the extent that cautious children are predisposed to lower achievement. Despite having lower academic scores than their non-cautious peers (Collins & O'Connor, In press), Cautious children in the study scored higher in Woodcock-Johnson Applied Problems when they experienced greater teacher-child closeness. Closeness, a characteristic of positive teacher-child relationships, seems to offer an

influential academic support to students and in turn, promotes greater child engagement and academic competence (Portilla, Ballard, Adler, Boyce, & Obradović, 2014; Baker, 2006; Pianta & Stuhlman, 2004; Peisner-Feinberg & Burchinal, 1997).

Given the axiomatic relationship between children's kindergarten and long-term academic achievement, this study's findings have unique significance. Kindergarten teacher-child relationships, whether marked by conflict or closeness, have implications for children's future school adjustment and academic progress (Hamre & Pianta, 2001; Ladd, Birch, & Buhs, 1999; Pianta & Nimetz, 1999; Birch & Ladd, 1997). This study offers insight into the role of teacher-child relationship quality on early academic development as well as the relationship between children's temperament and achievement. In better understanding the role of teacher-child relationships in child populations developmentally, temperamentally, and socio-economically susceptible to underachievement can inform academic supports that reduce children's academic risk and promote their long-term achievement.

5.1 Limitations

Despite this study's contributions to a sparse literature on the relationships between child temperament, teacher-child relationships, and child academic development, limitations exist. First, this study focuses on the kindergarten year. Albeit pivotal to children's future academic growth, kindergarten associations between children's temperament, teacher relationships, and academic achievement offer a snapshot of children's overall development. For example, this study's absence of associations between kindergarten teacher-child conflict and standardized math achievement belies the occurrence of associations between kindergarten teacher-child conflict and first grade math achievement (McCormick, O'Connor, Cappella, & McClowry, 2013; Hamre & Pianta, 2001). Future studies on the trifold dynamic of child temperament, teacher relationships, and child achievement would benefit from longitudinal research designs.

Second, in focusing on the baseline of a longitudinal intervention study (McClowry, O'Connor, & Cappella, 2008-2012), the resultant sample size was relatively small. After missing data was considered, the sample contained 275 children. With trends such as cautious children and teachers' limited interactions (Rudasill & Rimm-Kaufman, 2009; Rydell, Bohlin, & Thorell, 2005), an enlarged sample size would be helpful in further pinpointing whether the frequency of teacher-child interactions, child temperament, or teacher perceptions are responsible for children's academic development.

Third, this study focuses on teacher-child closeness and conflict in exploring the role of teacher-child quality on children's academic achievement. While teacher-child closeness and conflict offer a useful framework (Rudasill & Rimm-Kaufman, 2009; Jerome, Hamre, & Pianta, 2008; Ladd et al., 1999), there are additional components that inform the nature of teacher-child relationship quality. For example, the degree to which teachers display sensitivity, responsiveness, and focus on children's needs—all relate to children's cognitive and academic skill development (Rimm-Kaufman et al., 2002; Howes et al., 2000; Peisner-Feinberg & Burchinal, 1997). Future studies would do well to explore the role of either several or a couple additional components of teacher-child relationships in children's academic growth.

5.2 Implications for Practice

National standards (e.g., "No Child Left Behind") and school-based trends (i.e., data-driven decision-making) focus on children's assessment performance to promote high student achievement. Child assessments are undoubtedly one factor in understanding students' academic mastery. However, as this study reveals, there are multiple additional contributors to children's early academic development. The caliber of teacher-child relationships as well as the interplay between children's temperament and teacher relationships significantly affects children's academic outcomes. As a result, national and school-wide standards alike should holistically consider whether classroom climates are conducive for the academic growth of all children. There are several ways that educational policy and practitioners might ensure that this takes place.

First, in order to ensure that classrooms are conducive for children to achieve national and school-wide academic standards, administrators must be just as focused on teachers' relational abilities as they are with teachers' content knowledge. In the same manner that children's early skills influence children's future academic development (Duncan et al., 2007; La Paro & Pianta, 2000), the quality of teacher-child relationships also determine the extent to which children will realize their academic potential (Howes et al., 2000; Pianta, 1999; Lynch & Cicchetti, 1992). Furthermore, for children already at great academic risk, high quality teacher-child relationships are of distinct importance (Curby, Rudasill, Edwards, & Pérez-Edgar, 2011). Thus, teacher training programs and ongoing professional development should ensure teachers are both equipped to and maintaining

high quality relationships with each of their students. The nature of these relationships will differ by child temperament, teacher perceptions of child temperaments, and the interactions between the two (O'Connor, Cappella, McCormick, & McClowry, 2014; Koles, O'Connor, & Collins, 2013). Even so, it is critical to children's academic development that their classroom environments are responsive to their socio-emotional and academic needs (Teerikangas et al., 1998; Feinberg & Burchinal, 1997; Thomas & Chess, 1984). This means teachers should learn about child temperament profiles and teacher strategies that are responsive to children's temperament.

In particular, teachers must be equipped to support child temperaments that may not independently elicit the instructional support that they need (Rudasill & Rimm-Kauffman, 2009). More recent research, this study included, finds that cautious children are not only at increased risk for low academic development, but they are also at increased risk of being neglected by teachers' support structures (Rudasill & Rimm-Kaufman, 2009; Rydell, Bohlin, & Thorell, 2005). Subsequently, it is not only important that teachers are mindful of this trend, but they must also be trained in strategies to prompt cautious children's in-class participation and facilitate more frequent teacher-child interactions.

Second, and finally, in order for national and school-wide administrators to determine whether children are on track for meeting academic standards, the nature of the classroom climate must be considered. Children will not fully absorb instruction unless their classroom experience elicits their in-class engagement, participation, and fosters their ability to maximize instructional supports (Eggum et al., 2009). Close, non-conflictual teacher-child relationships have proven to promote children's high standardized and teacher-reported academic achievement (Baker, 2006; Schmitt, Pentimonti, & Justice, 2011; Peisner-Feinberg & Burchinal, 1997; Pianta & Steinberg, 1992). Consequently, a national and school-wide evaluative process of classroom climates is necessary to ensure that children are exposed to structures facilitating student learning. Several tools already exist, including the Classroom Assessment Scoring System (CLASS), the Danielson Framework, and Early Childhood Environment Rating Scale (Danielson, 2007; La Paro, Pianta, & Stuhlman, 2004; Harms, Clifford, & Cryer, 1998). Whatever the tool districts and individual schools decide upon, it is important that it is culturally relevant to the student demographic, implemented with fidelity, and used consistently across school years, as to allow teacher and student progress to be compared (Collins, Colwell, & Author3, 2012). In the end, this study's findings suggest that the quality of teacher-child relationships and child temperament are not only critical factors in children's early academic development, but also critical components worth including into teacher training, teachers' ongoing performance review, and overall efforts toward meeting national and district-wide academic standards.

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