

# The Role of a Temperament Intervention in Kindergarten Children's Standardized Academic Achievement

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## Abstract

Previous research finds that children experience a range of school readiness challenges (e.g., Chartier, Walker, & Naimark, 2010; Zill, 1999). Such challenges vary by children's gender, temperament, and participation in school-based interventions (e.g., Mullola et al., 2011; Bramlett, Scott, Rowell, 2000). However, the examination of child temperament, gender, and children's participation in school-based, temperament programming has been minimal. This study explores the role of child temperament profiles and child gender on children's standardized academic outcomes following participation in a school-based, temperament intervention. Study participants included 324 kindergarten students attending urban, low-income schools. A multivariate regression analysis explored associations among child temperament profile, gender, and academic performance. Cautious and male kindergarten intervention participants attained higher standardized mathematics and literacy scores than their non-intervention participating counterparts.

**Keywords:** temperament, kindergarten, urban, low-income, intervention

## 1. Introduction

A robust literature shows that school-based interventions can be promotive conduits for early child achievement (Webster-Stratton, Reid, & Hammond, 2001; Ramey et al., 2000; Schweinhart & Weikart, 1997). High-quality early childhood interventions can serve as an antecedent for children's later academic development (Maier, Vitiello, & Greenfield, 2012; Duncan et al., 2007; DiPerna, Volpe, & Elliot, 2005; Rimm-Kaufman, Pianta, & Cox, 2000; Shonkoff & Phillips, 2000). Given the importance of early academic success, numerous interventions focus on children's early development (Furlong, McGilloway, Bywater, Hutchings, Smith, & Donnelly, 2012; Fuchs, Fuchs, Thompson, Otaiba, Yen, McMaster, Svenson, & Yang, 2001; Webster-Stratton & Taylor, 2001; Domitrovich & Greenberg, 2000). A growing body of research finds temperament-based interventions instrumental in children's social, emotional, and academic development (Collins, O'Connor, McClowry, in progress, McClowry & Collins, 2012). Temperament-based interventions promote a goodness-of-fit between children's temperament and environment by tailoring caregiver responsiveness to meet children's socio-emotional supports needs (McClowry, 2003; Melvin, 1995).

Little research, however, exists on how the academic outcomes of temperament-based interventions may vary based on child gender and temperament. Child gender has long been associated with children's early academic skills (e.g., McWayne et al., 2012; Bramlett, Scott, & Rowell, 2000; Silver et al., 2005; Martin, 1989, 1994). Girls tend to outperform boys on early reading and mathematics assessments (Quirk, Nylund-Gibson, & Furlong, 2013; McCabe, Cunnington, & Brooks-Gunn, 2004; Willingham & Cole, 1997). Gender differences are likely to affect children's school-based intervention outcomes as well (Coddling, Chan-Iannetta, George, Ferreira, & Volpe, 2011; Kellam, Werthamer-Larsson, Dolan, Brown, Mayer, et al., 1991). Males in the control group tend to have more negative outcomes than non-intervention participating females (Conduct Problems Prevention Research Group, 2010; Domitrovich & Greenberg, 2000; Dolan, Kellam, Brown, Werthamer-Larson, Rebok, et al., 1993), and participating males tend to have greater intervention outcomes than participating females (Cameron, Rice, Sparkman, & Neville, 2013; Denham, Bassett, Thayer, Mincic, Sirotkin, & et al., 2012).

Child temperament can influence the ways children approach new academic endeavors, attend to instructional content,

collaborate with peers, and recover from academic setbacks (Zentner & Shiner, 2012; Prior, Sanson, Smart, & Oberklaid, 2000; Rothbart & Bates, 1998). Children with temperaments high in negative reactivity, activity, withdrawal or low in task persistence often face difficulties with early academic skill acquisition (Denham et al., 2012; Newman et al., 1998; Schaughency & Fagot, 1993). High negative reactivity can make the kindergarten transition particularly challenging, given the considerable change to children's daily routines (Pekrun et al., 2009; Schultz et al., 2009; Perbandt, 2007; McClowry, 2003; Gilliom et al., 2002; Carson & Bittner, 1994). Children high in activity can create classroom disruptions and other behavioral challenges for teachers (Rudasill & Rimm-Kaufman, 2009; Deater-Deckard, et al., 2005; Li et al., 2009; Rothbart & Jones, 1998). For highly withdrawn children, a hesitancy to engage in new experiences undermines their academic motivation and engagement (Gilman & Anderman, 2006; Davidson et al., 2000; Furnham & Mitchell, 1991). Children low in task persistence's difficulty attending results in prevalently low reading and mathematical achievement (Arnold, et al., 2012; McClelland et al., 2013; Rabiner et al., 2004).

Thus, the design and outcomes of interventions may vary by child temperament (Collins, O'Connor, McClowry, in progress; Social and Character Development Research Consortium, 2010; Veenstra, Lindenberg, Oldehinkel, de Winter, & Ormel, 2006). Preventive interventions strive to mitigate the temperamental risk of children high in activity, withdrawal, negative reactivity, and low in task persistence (Herman et al., 2011; Raver, et al., 2005, 2011; Webster-Stratton, Reid, & Hammond, 2001). Research also suggests that children at temperamental risk may benefit more from socio-emotional interventions than their low risk peers (McCormick, O'Connor, Cappella, & McClowry, 2015; Roorda, Koomeen, Thijs, & Oort, 2013; Wilson, Gottfredson, & Najaka, 2001). With a focus on creating a goodness-of-fit between child temperament and environment, temperament interventions may be uniquely positioned to influence children at risk of underachievement (Curby et al., 2011; Liew, Chen, & Hughes, 2010; Valiente, Lemery-Chalfant, Swanson, & Reiser, 2008; Zentner & Bates, 2008).

With kindergarten achievement associated with children's long-term academic development, it is an especially significant period to evaluate intervention efficacy (Rouse & Fantuzzo, 2009; Duncan et al., 2007; Konold & Pianta, 2005; Rimm-Kaufman, Pianta, & Cox, 2000). Nearly two-fifths of entering kindergarten students lacks the skills to acclimate to kindergarten academics and succeed in future grades (Zill, 1999). Low-income, male kindergarten children face greater academic risk. Children attending kindergarten in high poverty, urban neighborhoods face frequent stressors that can have enduring and diminishing effect on their mastery of new academic concepts (Chartier, Walker, & Naimark, 2010; Evans & Schamberg, 2009; Lloyd, Li, & Hertzman, 2009). Such neighborhoods routinely expose children to chronic community violence, failing schools, residential instability, and financial difficulty (Hair, Hanson, Wolfe, & Pollak, 2015; Bush, et al., 2011; Evans & Schamberg, 2009; Noguera, 2008, 2003; Garbino, Dubrow, Kostelny, & Pardo, 1992). All are factors that can increase the emotional, attentional, and social behaviors that impede children's ability to absorb new instruction and acquire positive school perceptions (Burke et al., 2011; Chartier, Walker, & Naimark, 2010; Sharkey, 2009; Brooks-Gunn, Duncan, & Aber, 1997).

Low-income, minority males are exposed to even greater societal risk factors than females (Noguera, 2003; Davis, 2003; Buka, Stichick, Birdthistle, & Earls, 2001). They are the observers of more violence, bearers of lower life expectancies, recipients of more school discipline, and possessors of more stress than their female counterparts (Rudd, 2014; U.S. Department of Education Office for Civil Rights, 2014; Wood, Kaplan, & McLoyd, 2007; Buka, Stichick, Birdthistle, & Earls, 2001). In kindergarten, low-income, males are disproportionately at-risk for low academic achievement (Denham, Bassett, Thayer, Mincic, Sirotkin, & Zinsler, 2012; Kohen, Oliver, & Pierre, 2009; McWayne, Cheung, Wright, & Hahs-Vaugh, 2004; NICHD ECCRN, 2003). Yet, research rarely addresses the role of multiple risk factors on children's participation in temperament-based interventions and early academic progress.

This study will consider the roles of child gender and temperament in urban, low-income kindergarteners' temperament-based intervention participation. The intervention, *INSIGHTS into Children's Temperament*, is a manualized temperament intervention that aims to enhance the socio-emotional and academic development of urban, low-income, early elementary children. *INSIGHTS* including teacher, parent, and child programs. Parents and teachers learn a framework for supporting children's temperamental. Children learn to a temperament lexicon and peer conflict resolution.

## 2. Literature Review

### 2.1 Social and Emotional Learning Interventions

Among the interventions supporting early child development, Social and Emotional Learning (SEL) interventions promote the development of children's social and emotional functioning (McIntosh, et al., 2012; Durlak et al., 2011; Blair & Razza, 2007; Zins et al., 2004; Hockenberger, Goldstein, & Haas, 1999; Velting & Whitehurst, 1997). For children at-risk for socio-emotional difficulties, SEL interventions have proven even more efficacious (Mathewson et al., 2012; Rudasill, Gallagher, & White, 2010). SEL interventions typically develop the attention, self-regulation, and social

skills instrumental in high academic performance (Blair & Diamond, 2007; Posner & Rothbart, 2005). While SEL programs focus on the development of children's self-regulatory and social skills, they often do so at the exclusion of child temperament (Durlak et al., 2011; Blair & Diamond, 2007; Posner & Rothbart, 2005; Izard, 2002; Compas et al., 1991).

## 2.2 Child Temperament

Child temperament refers to the constitutional differences in reactivity and self-regulation, which affect children's emotional, cognitive, attentional, and social responses (Zentner & Shiner, 2012). In the classroom setting, differences in child attention, activity, positive affect, and withdrawal/approach impact children's classroom engagement and academic performance (Cole, Martin, Dennis, 2004; Eisenberg, Fabes, Guthrie, & Reiser, 2000; Derryberry & Reed, 1996; Rothbart et al., 2000). The associations between child temperament and early academic outcomes are stronger than the association between children's cognitive aptitude and academic outcomes (Entwistle, Alexander, & Olson, 2005).

Temperament studies consistently mention four temperament dimensions for school-age children: task persistence, activity, withdrawal, and negative reactivity (Lyons-Thomas & McClowry, 2012; McClowry, 1995; Rothbart & Bates, 1998; Martin, Wisenbaker, & Huttenen, 1994; Martin, 1994). Task persistence refers to children's ability to sustain their attention on a task (Rothbart & Bates, 2006). Children high in task persistence complete assigned tasks, meet behavioral expectations, and usually demonstrate higher academic competence (Trentacosta & Izard, 2007; Bramlett, Scott, & Rowell, 2000; Martin & Holbrook, 1985).

Child activity refers to children's level of motor activity (Strelau & Zawadzki, 2012; Rothbart & Jones, 1998; Martin & Holbrook, 1985). High activity is associated with learning difficulties and low academic achievement (Schaughency & Fagot, 1993; Palisin, 1986; Martin & Holbrook, 1985). Withdrawal refers to children's level of behavioral inhibition and reluctance to engage in new interpersonal or environmental interactions (Neal & Edelman, 2003; Achenbach & Edelbrock, 1981). High withdrawal is believed to decrease children's academic motivation, participation in new learning experiences, and, in turn, diminish their attendance and grade point averages (Gilman & Anderman, 2006; Davidson et al., 2000; Furnham & Mitchell, 1991).

Child negative reactivity refers to children's tendency to exhibit negative responses to minor inconveniences (McClowry, 2003). High negative reactivity can inhibit children's attention, cooperative learning, academic motivation, and information recall (Pekrun et al., 2009; Schultz et al., 2009; Perbandt, 2007; Granziano, et al., 2007; Gilliom et al., 2002). Consequently, children with high negative reactivity have difficulty not only acquiring early academic skills but also are at risk for overall academic underachievement (Denham et al., 2012; Newman et al., 1998).

## 2.3 Child Temperament Profiles

While child temperament occurs on a continuum of individual dimensions, temperament profiles offer combinations of dimensions to explore the role of temperament on achievement (Althoff, Ayer, Crehan, Rettew, Baer, & Hudziak, 2012; Janson & Mathiesen, 2008). Temperament profiles can be created using factor analysis to identify reoccurring temperament dimension combinations from temperament questionnaires, and, then, using those reoccurrences to develop best-fit profiles (Gartstein et al., 2012; Zalewski et al., 2011; Rettew, et al., 2010; Caspi & Silva, 1995). Since child temperament profiles are derived from frequently occurring combinations of children's temperament, they are generalizable across temperament scales, analytical approaches, and study samples (Janson & Mathiesen, 2008).

Seminal temperament researchers Thomas, Chess, and Birch (1968) identified three temperament profiles—"easy," "difficult," and "slow-to-warm up"—in their New York Longitudinal Study. "Easy" profile children are high in approach, adaptation, and positive emotionality (Thomas & Chess, 1977; Thomas, Chess, & Birch, 1968). "Difficult" profile children are high in withdrawal, slow in adaptation, and high in negative emotionality (Thomas & Chess, 1977; Thomas, Chess, & Birch, 1968), and "Slow-to-warm up" children are high in withdrawal and slow to acclimate to new situations and social interactions (Thomas & Chess, 1977). Subsequent temperament research reinforces Thomas and Chess (1977)'s findings that temperamentally "easy" children tend to be easily adaptive to new environments, while "difficult" and "slow to warm up" children are at-risk for maladjustment (Zalewski et al., 2011; Aksan et al., 1999; Hart et al., 1997; Robins et al., 1996; Caspi & Silva, 1995).

McClowry (2002)'s temperament profiles combine aspects of Thomas and Chess (1977)'s "easy" and "difficult" profiles to focus on an early school-age sample. The temperament profiles include high maintenance, cautious/slow-to-warm up, industrious, and social/eager-to-try. Children with a high maintenance profile have temperaments that are high in activity and negative reactivity, and low task persistence. Cautious/slow-to-warm children are high in withdrawal. Children with an industrious profile exhibit high task persistence, low activity, and low negative reactivity. Social/eager-to-try children are low in withdrawal. Similar to Chess and Thomas' (1977) findings, high

maintenance and cautious/slow-to-warm up child profiles are considered "challenging" temperaments. Industrious and social/eager-to-try child profiles are considered "easy" temperaments (McClowry, 2002a).

Children of "easy" profiles tend to achieve at high academic levels, while children of "challenging" profiles achieve at low academic levels (Thomas, 2003; Blair, 2002; Bramlett, Scott, & Rowell, 2000; Guerin, et al., 2000; Martin, 1989). Researchers believe that the academic differences between "easy" and "challenging" child temperaments could be the result of any number of factors, including temperamentally-based differences in children's self-regulation, academic motivation, and teacher/child relationship quality (Koles, O'Connor, & Collins, 2013; Walker & Henderson, 2012; Al-Hendawi & Reed, 2012; Rimm-Kaufman, Curby, Grimm, Nathanson, & Brock, 2009; Rudasill & Rimm-Kaufman, 2009; Guerin, Gottfried, Oliver, & Thomas, 2003). Regardless, child temperament is a factor of increasing importance in children's academic success (Collins, O'Connor, McClowry, in progress; Zentner & Shiner, 2012; Mendez, Fantuzzo, & Cicchetti, 2002; Martin, Olejnik, & Gaddis, 1994).

#### 2.4 Temperament Based Interventions

Chess and Thomas (1999) found that goodness of fit, or a match between a child's temperament and environment, promotes positive child development among all temperaments. Temperament-based interventions tailor socio-emotional supports to meet children's temperamental needs and enhance the goodness-of-fit between children and their environments (Zentner & Bates, 2008; Bates & Pettit, 2007; Rothbart & Bates, 2006; McClowry, 2003; Thomas & Chess, 1977). Goodness of fit can ease children's school transition, enhance teacher/child relationships, and protect children against academic risk factors, including those stemming from child temperament, gender, and socio-economic status (Curby et al., 2011; Liew, Chen, & Hughes, 2009; Valiente et al., 2008; McClowry, 2003; Teerikangas et al., 1998).

#### 2.5 Child Temperament and Temperament-based Interventions

Temperament-based interventions enhance a goodness of fit based on the belief that a bidirectional interaction between child temperament and children's environment influences child outcomes (Lengua & Kovacs, 2005; Chess & Thomas, 1999). When there is a goodness of fit between child temperament and classroom environment, children can achieve positive school outcomes, including high academic achievement (Collins & O'Connor, 2016; McClowry, Rodriguez, & Koslowitz, 2008; O'Connor & McCartney, 2007; Hamre & Pianta, 2001; McClowry, 2003; Chess & Thomas, 1999; Melvin, 1995). Children of differing temperaments are likely to experience and attain different outcomes from classrooms and interventions, based on whether such circumstances produce a goodness- or poorness- of fit (McClowry & Collins, 2012; Zentner & Shiner, 2012; O'Connor, Cappella, Rodriguez, & McClowry, 2010). For example, a hospital management organization (HMO)-based intervention provided preschool-age parents with temperament-based, parenting literature (Cameron, Rice, Sparkman, & Neville, 2013). Among the children whose parents participated in the intervention, the greatest behavioral change occurred in children of "challenging" temperaments. The temperamentally challenging participants had fewer behavior-related, pediatric visits.

Similarly, past research on the *INSIGHTS into Children's Temperament*, the program on which this study is based, finds "challenging," high maintenance children receive quicker decreases in off-task and disruptive behaviors compared to children of social, cautious, and industrious temperament profiles (McCormick, O'Connor, Cappella, & McClowry, 2015; McClowry, Rodriguez, Tamis-LeMonda, Spellman, Carlson, & Snow, 2013; O'Connor, Rodriguez, Cappella, Morris, & McClowry, 2013). Cautious children also achieved speedier academic development in math and critical thinking than social children (O'Connor, Cappella, McCormick, & McClowry, 2014).

#### 2.6 Temperament-based Interventions and Child Gender

In addition to child temperament, gender may also affect children's intervention outcomes. Child gender has already proved to moderate academic outcomes (Lawson & Ruff, 2004; Kochanska et al., 1996). Demonstrated gender differences exist in children's teacher relationship quality (Stipek & Miles, 2008; Rudasill & Rimm-Kaufman, 2008; Pianta, et al., 2002), teachers' expectations of students (Denham, Bassett, Mincic, Kalb, Way, Wyatt, & Segal, 2012; Wood, Kaplan, & McLoyd, 2007; McClowry, 2002; LaFreniere & Dumas, 1996), and overall academic achievement (Quirk, Nylund-Gibson, & Furlong, 2013; McCabe, Cunningham, & Brooks-Gunn, 2004; Willingham & Cole, 1997). Teacher-child relationships among female students are closer and less conflictual than male students (Baker, 2006; Hamre & Pianta, 2001; Birch & Ladd, 1997). Teachers perceive male students as having more behavior problems and less school readiness skills than female students (McWayne, Cheung, Wright, & Hahs-Vaughn, 2012; Kohen, Oliver, & Pierre, 2009; LaFreniere & Dumas, 1996). Moreover, females with positive teacher/child relationships attain greater school outcomes than males experiencing the same relationship quality (Baker, 2006).

It remains unclear whether temperamentally different outcomes occur as a function of child gender. Teachers tend to view male students as not only possessing the components associated with "challenging" temperaments (high negative

reactivity and activity), but also as possessing low academic competence (Denham, Bassett, Mincic, Kalb, Way, Wyatt, & Segal, 2012; Valiente, Lemery-Chalfant, & Swanson, 2010; Prior, Sanson, Smart, & Oberklaid, 2000; LaFreniere & Dumas, 1996; McClowry, Giangrande, Tommasini, Clinton, Foreman, & Ferketich, 1994). Conversely, teachers view female students as displaying the components of “easy” temperaments (high in task persistence and low activity) and high academic competence (Valiente, Swanson, & Eisenberg, 2012; Deater-Deckard, Mullineaux, Petrill, Thompson, & DeThorne, 2009; McClowry, 2002; LaFreniere & Dumas, 1996; Fergusson, Lloyd, & Horwood, 1991).

### 2.7 Current Study

This study will investigate associations between children’s temperament, gender, temperament intervention participation, and academic development. Additionally, this study will focus on a program underrepresented in intervention literature, temperament-based programming, and a population especially susceptible to low achievement—urban, kindergarten students attending high poverty schools. Identifying the processes that may underlie child temperament and academic development can inform early school supports and potentially protect against early low achievement. The following research questions will be tested:

- 1) What are the effects of *INSIGHTS into Children’s Temperament* on the academic development of low-income, urban kindergarten children?
- 2) What is the role of gender and temperament typology in children’s academic development?

## 3. Methods

### 3.1 Participants

Analyses were conducted on a sample of 324 students from twenty-two underserved, urban elementary schools. Students attended 120 classrooms and ranged in age from four to seven ( $M = 5.55$  years). Fifty-two percent of the students were male. The majority of the students were African-American (72%) or Latino (19%), and they qualified for free or reduced lunch (87%). Participating teachers were predominately female (94.2%) and African-American (56.4% African-American). A sizeable amount of teachers were also White (24.3%), Latino (11.9%), and of mixed or other races (7%). After baseline data was collected, participating schools were randomly assigned to the *INSIGHTS into Children’s Temperament* program or an attention control, reading program.

### 3.2 Procedure

Participant teachers and kindergarten families were recruited via letters, fliers, telephone calls, and brief parent meeting presentations. Once a parent provided consent, their child was asked for their assent. Parents completed the School-Aged Temperament Inventory (McClowry, 1995), and trained observers administered the Woodcock-Johnson Applied Problems and Woodcock-Johnson Letter-Word subtests to determine children’s reading and math skills. Data was collected across five time points: in early kindergarten, after a 10-week intervention, at the beginning of 1<sup>st</sup> grade, after the completion of the 10-week intervention, and at the end of 1<sup>st</sup> grade. This study was conducted with three cohorts and focuses on the pre- and post- intervention data for kindergarteners across three academic years (2009-2012).

### 3.3 Program Description

Data for the current study was from the Prevent III *INSIGHTS into Children’s Temperament (INSIGHTS)* study (McClowry, O’Connor, & Cappella, 2008-20012). *INSIGHTS* is a temperament-based, manualized, Tier 1 preventive intervention that includes teacher, parent, and child components. Teachers and parents were taught how to foster a goodness-of-fit between child temperament and child environment by using the three R’s—Recognize, Reframe, and Respond (McClowry, 2002a, 2002b). Participants learn to *recognize* child behavior as offshoots of unique temperament types (McClowry et al., 2009); *reframe* their perceptions of temperament by acknowledging that all profiles have strengths and challenges; and *respond* to child temperament in ways that facilitate a goodness of fit (McClowry, 2009). The adult workshops were delivered in two-hour, weekly-facilitated sessions, over a 10-week period. Sessions relied on a structured curriculum that included didactic content, videotaped vignettes, session handouts, and group discussion.

During the same 10-week period, kindergarten children participated in weekly, 45-minute classroom sessions. In the children’s sessions, a facilitator used vignettes and drama therapy techniques to teach children conflict resolution and that temperament may lead to situational ease or challenge. Workbook sheets and vocabulary flash cards were also used to extend children’s understanding of temperament and problem solving.

Children were introduced to four puppets, which each represented a temperament profile—Coretta the Cautious, Fredrico the Friendly, Gregory the Grumpy, and Hilary the Hardworker (McClowry, 2002). Coretta the Cautious embodies the cautious/slow to warm up temperament profile. She is high in withdrawal and reticent with new people and experiences. Fredrico the Friendly reflects the social/eager to try temperament profile. He is high in approach and enthusiastically embraces new experiences and people. Gregory the Grumpy possesses the high maintenance

temperament profile. He is highly active, highly reactive to disappointments, and easily distracted during task completion. Hilary the Hardworker represents the industrious temperament profile. She approaches her tasks with conscientiousness, her movements with restraint, and her disappointments with a positive, resiliency.

In schools assigned to the attention control, children participated in a supplementary reading program for ten weeks after school. They received a comparable number of adult interactions as students participating in *INSIGHTS* to control for any child outcomes resulting from ten, consecutive weeks of additional adult interactions. Teachers read a different book weekly and children were asked to discuss and draw about the story. At the close of the ten weeks, the post-intervention questionnaires were redistributed.

#### 4. Measures

*School-Age Temperament Inventory.* Child temperament was assessed using the *School-Age Temperament Inventory* (SATI; McClowry, 2002). The SATI is a 38-item, parent-reported, five-point Likert-response scale (where 1 = never, 3 = sometimes, and 5 = always). Using a nationally diverse sample of 883 parents, the SATI was standardized and identifies students' levels of withdrawal, task persistence, negative reactivity, and activity. The Cronbach's alphas for the SATI in this study are included below. Cronbach's Alphas for the School-Age Temperament Inventory

Activity	$\alpha = 0.77$
Negative Reactivity	$\alpha = 0.87$
Task Persistence	$\alpha = 0.70$
Withdrawal	$\alpha = 0.81$

*Woodcock-Johnson III Tests:* The Woodcock-Johnson Applied Problems and Woodcock-Johnson Letter-Word subtests were used to assess children's math and reading achievement, respectively (Woodcock, McGrew, & Mather, 2001). The Applied Problems subtest measures children's quantitative reasoning, math knowledge, and math achievement through 39 items (Wendling, Schrank, & Schmitt, 2007). The Applied Problems subtest has a reliability of 0.93 (SE = 4.08). The Letter-Word Identification subtest measures children's reading decoding through 76 items. The Letter-Word Identification subtest has a reliability of 0.94 (SE = 3.81).

#### 5. Analysis

The role of *INSIGHTS*, a school-based temperament intervention, in promoting kindergarteners' academic development will be considered in a simple linear regression analysis. Child temperament profiles were created by, first, determining the level of intensity that children exhibited each of the four temperament dimensions (i.e., task persistence, negative reactivity, activity, and withdrawal). Low intensity levels occurred when temperament dimension values fell below the mean. Moderate intensity occurred for temperament dimensions within the mean, and high intensity occurred for dimensions 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 social/eager-to-try profile was low in withdrawal, while the cautious/slow-to-warm up profile was high in withdrawal. Over eighty-nine percent (M = 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 (M = 39%) or the cautious/slow-to-warm up profile (M = 30%). Thirteen percent of the study population qualified as an industrious profile, and nearly eight percent qualified as a high maintenance profile (M = 7.6%).

A correlation analysis of the temperament profile variables was conducted (Table 1). It revealed that the social/eager-to-try profile was significantly correlated to the high maintenance ( $r = -0.119$ ,  $p = 0.049$ ) and cautious/slow-to-warm up ( $r = -0.53$ ,  $p < 0.001$ ) profiles. Given the high correlation, the social/eager-to-try profile was omitted from the analyses. As a result, all temperament profile findings were conducted in relation to the excluded social/eager-to-try profile.

Table 1. Pearson's Product Moment Correlations for Child Temperament Profiles

	Temperament Profiles			
	High Maintenance	Cautious	Industrious	Social
High Maintenance	1	0.079	-0.113†	-.119*
Cautious	0.079	1	-.120*	-.529**
Industrious	-0.113†	-.120*	1	-0.098†
Social	-.119*	-.529**	-0.098†	1

Note. † =  $p \leq .10$ , \* =  $p \leq .05$ , \*\* =  $p \leq .01$  N = 275 for all analyses.

A correlation matrix was, then, created to examine associations among the children's three remaining temperament profiles (high maintenance, cautious, and industrious), demographics, and temperament-based program participation to check for potential multicollinearity (See Table 2).

Table 2. Pearson's Product Moment Correlations for Child Demographics

	Controls			Child Temperament		
	Child Male	Parent Education	Program Participation	High Maintenance	Cautious	Industrious
Child Male	1.00	0.03	0.00	0.09†	-0.02	-0.06
Parent Education	0.03	1.00	-0.19**	0.03	-0.18**	0.04
Program Participation	0.00	-0.19**	1.00	-0.05	-0.06	0.11†
High Maintenance	0.09†	0.03	-0.05	1.00	0.08	-0.11†
Cautious	-0.02	-0.18**	-0.06	0.08	1.00	-0.12*
Industrious	-0.06	0.04	0.11†	-0.11†	-0.12*	1.00

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

Child temperament, gender, and parental education were entered as control variables in the regression model predicting children's literacy and mathematical skills. Child gender (where 0 = female and 1 = male) and child intervention participation (where 0 = not a participant in the intervention and 1 = participant in the intervention) were both dummy coded. Parent education was coded using the following four categories: 0 = did not complete high school, 1 = completed high school, 2 = completed some college, and 4 = completed college.

Child gender, temperament, and program participation were entered into the regression model to predict children's academic skills, along with three, two-way interaction terms (children's program participation X children's temperament profiles) to determine whether intervention outcomes varied as a function of child temperament. An additional two-way interaction term (children's program participation X children's gender) was added to examine whether intervention outcomes varied as a function of child gender. Finally, three, three-way interaction terms (children's program participation X child temperament X child gender) were added to explore whether intervention outcomes varied as a result of both children's gender and temperament. Significance was tested.

*Missing Data.* Common to school-based research (Puma, et al., 2009), there was missing student data due to random student absences, family travel, transiency, or occasional conflicts between the school calendar and research collection. Since the data was missing randomly, listwise deletion was used. Following listwise deletion, the final sample size was 275.

## 6. Results

What are the effects of INSIGHTS into Children's Temperament on the academic development of low-income, urban kindergarten children?

There was a statistically significant effect of children's participation in the *INSIGHTS into Children's Temperament* program on children's literacy performance (See Table 3). Between entering kindergarten (baseline) and mid-fall of kindergarten, children's participation in the temperament-based program was inversely related to their Woodcock-Johnson Letter Word ( $b = -2.10$ ,  $SE = 0.62$ ,  $p \leq 0.01$ ). The inverse relationship between children's program participation and Woodcock-Johnson Applied Problems scores was not statistically significant ( $b = -0.37$ ,  $SE = 0.51$ ,  $p = 0.47$ ).

Table 3. Child gender, temperament, and program participation predicting Woodcock Johnson scores

	Letter Word		Applied Problems	
	b	SE	b	SE
Constant	8.21**	1.87	11.95**	1.53
Child Male	-0.85	0.61	-1.14	0.50
Parent Education	0.13	0.12	0.05	0.10
Program participation	-2.10**	0.62	-0.37	0.51
Woodcock-Johnson (T1)	0.78**	0.04	0.31**	0.03
Cautious	0.09	0.67	-0.61	0.55
High Maintenance	-2.58*	1.19	-1.06	0.97
Industrious	0.00	0.91	-0.66	0.75

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

What is the role of gender and temperament typology in children's academic development?

Gender and child temperament proved to influence children's intervention outcomes and academic development. Gender had a statistically significant moderation effect on children's *INSIGHTS* program participation and Woodcock-Johnson Applied Problems ( $b = -1.55$ ,  $SE = 0.93$ ,  $p \leq 0.10$ ) scores. Male program participants scored lower on the Woodcock-Johnson Applied Problems assessment than females in the intervention. There was no gender moderating effect for child program participation and Woodcock-Johnson Letter Word scores.

While child temperament did not moderate the relationship between children's program participation and academic performance, high maintenance children scored significantly lower on the Woodcock-Johnson Letter Word assessment

( $b = -2.58$ ,  $SE = 1.19$ ,  $p \leq 0.05$ ) compared to children of other temperament profiles. There were no temperamental effects on children's Woodcock-Johnson Applied Problems performance.

The interaction of child gender, temperament, and program participation did have a statistically significant moderation effect on children's academic performance. For literacy performance, industrious males in the intervention scored higher on the Woodcock-Johnson Letter-Word assessment than their non-participating counterparts ( $b = -3.79$ ,  $SE = 2.02$ ,  $p \leq 0.10$ ). For math performance, cautious males in the intervention scored higher on the Woodcock-Johnson Applied Problems than non-participating cautious males ( $b = -2.43$ ,  $SE = 1.11$ ,  $p \leq 0.05$ ). There were no statistically significant effects for any of the other three-way interaction terms.

## 7. Discussion

This study found that child gender, temperament, and participation in a temperament-based program influenced kindergarten children's standardized literacy and math scores. It also showed that study main effects do not always offer a complete depiction of study outcomes. The study main effects found children's program participation negatively influenced children's literacy scores. However, upon closer examination, the interaction effects reveal higher literacy and mathematics scores for subsets of program participants. Such population-specific observations are of particular importance given that it is child subsets (including kindergarteners, low-income children, challenging child temperaments, and boys) who are at risk for academic and intervention underachievement (McWayne, Cheung, Wright, & Hahs-Vaughn, 2012).

Among the subsets of children who received academic gains following the study's program participation were children at risk for low achievement—including cautious children and male children. Male kindergartners not only have disproportionately lower academic readiness skills than females (Denham et al., 2012; McWayne et al., 2004; Wills, et al., 1996), but are also perceived by teachers to have lower academic ability (Kohen, Oliver, & Pierre, 2009; Baker, 2006; Hamre & Pianta, 2001). Yet, male children in this study attained higher literacy scores when they both participated in the temperament-based program and possessed an industrious temperament profile.

Additionally, cautious children are predisposed toward low academic achievement (Viljaranta, Aunola, Mulla, Virkkala, Hirvonen, et al, 2015; Rudasill & Rimm-Kaufman, 2009; Rydell, Bohlin, & Thorell, 2005). Their reserve minimizes interactions with teachers and peers, circumventing two proven academic supports (Collins & O'Connor, 2016; Koles, O'Connor, & Collins, 2013). However, cautious boys in this study, who participated in the program, attained higher math scores than program-participating girls.

It is possible that the temperament program's adult workshops increased teacher awareness and responsiveness to all children, including the typically overlooked cautious and male children (Rudasill & Rimm-Kaufman, 2009). Close teacher/child relationships and teacher responsiveness have proven especially beneficial to the academic development of cautious children (Collins & O'Connor, 2016; Viljaranta, Aunola, Mulla, Virkkala, Hirvonen, et al, 2015; Koles, O'Connor, & Collins, 2013). Cautious and male children also seem to respond especially well to temperament-based interventions (Collins, O'Connor, & McClowry, In progress; Viljaranta, Aunola, Mulla, Virkkala, Hirvonen, et al, 2015; O'Connor, Cappella, McCormick, & McClowry, 2014; Kochanska et al., 1996).

Additionally, this study reinforced previous research that male students and students with challenging temperaments score lower on kindergarten academic measures (Denham et al., 2012; Stright, Gallagher, & Kelly, 2008; NICHD ECCRN, 2003; Bramlett, Scott, & Rowell, 2000). Male program participants scored lower on the standardized mathematics assessment compared to their female peers, and children with the challenging, high maintenance temperament scored lower on the standardized literacy assessment than other temperament profiles. The kindergarten transition as well as children's acclimation to intervention participation may have compounded the amount of change high maintenance children faced. The increased dissonance between children's temperament and new environmental may have resulted in high maintenance children's low literacy achievement.

## 8. Limitations

This study focuses on children's program participation and academic achievement at the initial stages of school adjustment, the beginning through the late fall of children's kindergarten year. While the stage is critical to children's enduring attitudes toward school, student-teacher relationship quality, and academic trajectory (Baker, 2006; Silver et al., 2005; Pianta & Stuhlman, 2004; Hamre & Pianta, 2001; Alexander, Entwisle, Blyth, & McAdoo, 2012), it is only a snippet of children's overall kindergarten experience. Research that includes multiple time points across the kindergarten year could contribute to the temperament intervention literature.

Second, this study focuses on the roles of child temperament and gender on the relationship between children's program participation and early achievement. Study program participation may have changed the quality of teacher-child relationships, which in turn, affected the relationship between child characteristics (such as temperament and gender)



and academic outcomes. Future research would do well to investigate the potential role of additional factors.

Third, temperament intervention outcomes were compared to an attentional, control program. Despite intending for the control to offer comparable amounts of teacher-child interactions as the intervention group, it is possible that the program also offered an unintentional, literacy intervention. The control's use of teaching professionals, quality literature, and related comprehension activities may have enhanced children's literacy performance.

Fourth, and finally, once missing data was considered, the sample consisted of 275 children. Despite, a fairly small sample, the study findings offer a noteworthy contribution to temperament intervention research, particularly for kindergarten children, attending schools in urban, low-income neighborhoods. Still, future research on this topic and demographic would benefit from a larger sample size.

### 9. Implications for Practice

It is customary for intervention research to rely on study main effects to determine program efficacy (Blasé Fixsen, Sims, & Ward, 2014). While the main effects in intervention research offer a valuable perspective on program outcomes, an exclusive focus on main effects can overlook the nuances of subgroup participant experiences (Kam, Greenberg, & Walls, 2003; Ialongo, Werthamer, Kellam, Brown, Wang, & Lin, 1999). In this study, the main effects found intervention participation to negatively influence kindergarteners' literacy scores. ~~Taken at face value, this study's temperament-based intervention could have been easily dismissed as inefficacious.~~ However, further investigation into the study's interaction effects revealed that the main effects belied the intervention's positive influence on two academically at-risk groups, kindergarten males and cautious child temperaments. As a result, it is critical to consider both main and interaction effects in order to establish a comprehensive understanding of intervention implementation and outcomes.

This study's temperament-based intervention proved especially beneficial to child subgroups at risk of low academic performance. Industrious and cautious kindergarten males who participated in the intervention attained higher literacy and math scores, respectively, than their non-participating counterparts. Their academic success highlights the utility of temperament-based programming for children at risk for academic underachievement. While the specific intervention mechanisms instrumental in children's academic performance could stand further study, two components of temperament-based intervention present in this study may offer a helpful starting point: (1) establishing "goodness of fit," and (2) reframing child behavior. The "goodness of fit" framework requires examination of the interactive relationships between children's individual characteristics, classroom climate, and intervention participation. Reframing child temperament recognizes that all temperament profiles have strengths and areas of challenge. Building teacher program participants' skill in reframing child behavior may influence teacher perception, teacher-child relationship quality, and children's academic outcomes.

Reframing child behavior is a "best practice" that teachers and intervention practitioners can adopt in their interactions with children to ease a common site of practitioner stress and turnover—classroom behavior management (Klassen & Chiu, 2010; Jennings & Greenberg, 2009). In reframing children's behavior, teachers and intervention facilitators expand their locus of control to include opportunities to facilitate a goodness of fit, rather than viewing challenging child behavior as a challenge to their authority. This is of particular importance given the simultaneous occurrence of negative teacher perception of "challenging" child temperaments and male students alongside both student groups' poor teacher-child relationships and low academic achievement (Collins & O'Connor, 2016; Stipek & Miles, 2008; Rudasill & Rimm-Kaufman, 2008; Perbandt, 2007; Wood, Kaplan, & McLoyd, 2007; Schauthency & Fagot, 1993). With child behavior management negatively effecting teacher stress and retention (Klassen & Chiu, 2010; Jennings & Greenberg, 2009), the skill of reframing child behavior may also minimize teacher stress, retain teachers, and facilitate positive teacher-child relationships.

Finally, consistent with previous research (Dissertation 1; Stright, Gallagher, & Kelly, 2008; Coplan, Gavinski-Molina, Lagac-É-Séguin, & Wichmann, 2001), high maintenance, cautious, and male children achieved lower academic scores than children of other temperaments and female students. Consequently, intervention efficacy must be evaluated with an understanding that program components affect children differently (Durlak et al., 2011; Ramey & Ramey, 1999). To this end, interventions as well as school-, district-, and nation- wide education policy efforts must consider the gender, temperament, and context of participating children (Durlak et al., 2011; Domitrovich, Bradshaw, Poduska, Hoagwood, Buckley, et al., 2008).

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