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Kindergarten School Engagement: Linking Early Temperament and Academic Achievement at the Transition to School

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Abstract

Research Findings: Although children’s temperament contributes to their academic success, little is known regarding the mechanisms through which temperament is associated with academic achievement during the transition to elementary school. One such mechanism may be school engagement, but findings are inconsistent and limited. Across two waves of data at the transition to school, we examined the role of kindergarten emotional and behavioral engagement as links between preschool temperament (*positive emotionality, anger, and effortful control*), and kindergarten academic achievement, among a predominantly Mexican/Mexican-American sample of 241 children drawn from Head Start classrooms. Significant direct effects indicated that preschool anger was negatively, and positive emotionality and effortful control were positively, associated with kindergarten behavioral engagement. Only preschool anger was significantly associated with kindergarten emotional engagement. In turn, kindergarten behavioral, but not emotional, engagement was directly, positively associated with kindergarten academic achievement. All three preschool temperament measures were indirectly related to kindergarten achievement via kindergarten behavioral engagement, and anger was indirectly related to kindergarten achievement via emotional engagement.

Practice or Polic: Findings highlight the importance of understanding the role of engagement as a mechanism that can foster children’s academic achievement at a key developmental transition.

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Keywords

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Kindergarten represents a sensitive period for later school success (Rimm-Kaufman & Pianta, 2000); thus, examining academic processes occurring at the transition to and across this critical year is worthwhile. Numerous factors, both external and internal, have been shown to influence academic functioning, with implications for academic functioning, including characteristics of the home, the individual child, and the social context (Buhs & Ladd, 2001; Downer & Pianta, 2006; Ladd, Buhs, & Seid, 2000). At the child-level, temperament predicts academic success across elementary school (Nelson, Martin, Hodge, Havill, & Kamphaus, 1999), yet precisely how temperament is associated with academic success at the kindergarten transition warrants further study. Specifically, children's school engagement may act as a process variable linking children's temperament and achievement (Valiente, Lemery-Chalfant, & Castro, 2007).

Moreover, a better understanding of how temperament affects academic performance through school engagement may be especially important for children at-risk academically. Latino children, for example, are among a growing United States population that displays the highest risk of academic failure and the least educational attainment (Kohler & Lazarin, 2007), and disparities are found as early as the start of formal schooling (Duncan & Magnuson, 2005). This persistent lag in Latino student performance, particularly early in school, necessitates investigations that may promote positive academic outcomes among this group. Accordingly, with this study, we followed a sample of low-income, mostly Mexican/Mexican-American children enrolled in Head Start classrooms from preschool through kindergarten to examine their engagement in kindergarten as a possible mechanism linking preschool temperament to kindergarten year-end achievement.

The Importance of School Engagement for Academic Success

A burgeoning literature indicates that the levels at which children actively engage in early learning environments are important for academic outcomes longitudinally from kindergarten through high school (Ladd et al., 2000; Ladd & Dinella, 2009). *School engagement*, which refers to feelings and overt manifestations of motivation, is a multi-faceted construct consisting of three distinct types of engaging in school—behavioral, emotional, and cognitive (see Fredricks, Blumenfeld, & Paris, 2004; Fredricks & McCloskey, 2012). In the present study, we focused on children's affective connection to school (i.e., *emotional engagement*) and their cooperative and independent active classroom involvement (i.e., *behavioral engagement*; Buhs & Ladd, 2001), as these are most often measurable in young samples.

Children high in engagement generally have positive feelings about school, adhere to classroom rules, and appropriately respond to teachers' expectations (Buhs & Ladd, 2001; Ladd et al., 2000). In contrast, children low in school engagement are uncooperative, resist rules, and are inattentive (e.g., Ladd, Birch, & Buhs, 1999). Furthermore, emotional

engagement appears to lay the foundation for behavioral engagement (Ladd et al., 2000), such that children who feel connected to school increase their classroom participation. Given that emotional engagement may precede behavioral engagement, it is important that the two types of engagement be considered as unique constructs. The importance of school engagement for early academic success across grades warrants examinations of child-level antecedents of school engagement, including how children's temperament may predict engagement in school.

Temperament and School Engagement

Rothbart and colleagues defined temperament as “constitutionally based individual differences in reactivity and self-regulation” (Rothbart, Ellis, & Posner, 2004, p. 357). Reactivity refers to involuntary aspects of temperament, including the “arousability of motor, affective, and sensory response systems” (p. 1395), which is captured via positive and negative emotionality (Rothbart, Ahadi, Hershey, & Fisher, 2001), whereas regulation refers to intentional modulation of reactivity, measured via effortful control (EC) (Rothbart et al., 2004). Positive emotionality includes positive affect behaviors such as smiling and laughing (Putnam, Rothbart, & Gartstein, 2008). Negative emotionality is operationalized as the intensity of experiencing negative affect (i.e., anger, fear, and sadness; Rothbart & Bates, 2006). We focused on two types of reactivity (positive emotionality, measured as smiling/laughter and anger) and regulation (effortful control, or *EC*).

There is some evidence regarding the role of temperamental reactivity in children's learning and academic development (Schutz & Pekrun, 2007), though theoretical and empirical work is mixed regarding positive emotionality (see Linnenbrink, 2007). Appropriate positive emotionality can support children's enthusiasm, sustained interactions, and motivation and should be an important precursor of school engagement (Cole, Michel, & Teti, 1994; Rothbart & Jones, 1998). In the only study to test associations during early childhood to our knowledge, (Diaz and colleagues 2015) showed that, among a majority Caucasian sample, positive emotionality (e.g., smiling, grinning, laughter) was not a significant predictor of kindergartners' behavioral engagement. Theoretically, it would seem that positive emotionality is an important precursor of school engagement; however, there is limited research on this topic, thereby necessitating the examination of whether and why positive emotionality predicts achievement, particularly as children transition to school. For this reason, our goal was to examine positive emotionality, as measured via positive manifestations including smiling and laughing, is related to children's engagement during the transition to school.

Associations between children's anger and lack of engagement are more consistent. Children prone to anger may experience more personal distress (i.e., self-centered empathy; see Eisenberg, Fabes, Carlo, & Karbon, 1992), which can affect emotional engagement in the classroom (Eisenberg et al., 2006). Similarly, children prone to anger grow over-aroused when their needs conflict with others, likely limiting cooperative behavior, a key component of behavioral engagement. Indeed, negative associations are apparent between anger and both behavioral engagement and emotional engagement, among middle-SES majority Caucasian samples (Diaz et al., 2015; Valiente, Swanson, & Lemery-Chalfant, 2012).

Children's EC, which encompasses attention, emotion, and behavior regulation abilities, appears important for engagement in school throughout children's academic careers (Blair, 2003; Eisenberg, Valiente, & Eggum, 2010). Because teachers and peers prefer to interact with well-regulated students (Keogh, 2003; Myers & Pianta, 2008), students with high levels of EC likely feel a sense of belonging and connectedness to school, feelings characteristic of emotional engagement. Indeed, EC is positively associated with children's school liking among both Latino and Caucasian children (Valiente et al., 2007; Valiente et al., 2012). Moreover, children high in EC can regulate behaviors, follow instructions, and remain focused on activities in the classroom (Rothbart & Jones, 1998), congruent with behaviors used to characterize behavioral engagement (Brock, Rimm-Kaufman, Nathanson, & Grimm, 2009). A study conducted by (Valiente and colleagues 2012) examined relations between adult-reported (e.g., parent and teacher) anger and observed and adult-reported EC and both emotional and behavioral engagement among a middle-SES majority Caucasian kindergarten sample. Adult-reported EC positively predicted both types of engagement in separate models; however, observed EC only predicted behavioral engagement. This investigation introduced a promising direction, but further research is necessary to better understand these relations.

School Engagement as a Potential Process Mechanism Linking Temperament and Achievement

Scholars have called for investigations of possible processes through which temperament is indirectly related to children's academic achievement via engagement (e.g., Duckworth & Allred, 2012). Despite the well-documented association from *EC* to achievement through school engagement, to our knowledge, only one study has examined the indirect association of *emotionality* and achievement through either emotional or behavioral engagement. With a sample of majority African American upper-elementary children, Kwon, Hanrahan, and Kupzyk (2016) found that positive and negative emotional expressivity were indirectly associated with achievement through behavioral engagement.

Several studies have documented an indirect association from *EC* to achievement through school engagement. Specifically, *EC* was indirectly associated with achievement through either emotional engagement (among majority Latino upper elementary students; Valiente et al., 2007) or behavioral engagement (among primarily Caucasian kindergartners and Latino upper elementary students; Valiente, Lemery-Chalfant, Swanson, & Reiser, 2008; Valiente, Swanson, Lemery-Chalfant, & Berger, 2014). Additionally, when school engagement was examined as a single variable encompassing both emotional and behavioral engagement, both concurrent and longitudinal indirect associations between *EC* and achievement were evident (among first- and third-graders; Iyer, Kochenderfer-Ladd, Eisenberg, & Thompson, 2010). However, most investigations do not encompass important developmental transitions (e.g., preschool to kindergarten) which set the stage for children's future academic success, and models tend to focus on *either* emotional or behavioral engagement, as opposed to both modeled distinctly within a comprehensive model (Diaz et al., 2015; Iyer et al., 2010; Valiente et al., 2007). This approach precludes identifying associations between emotional

and behavioral engagement, as well as how each may be differentially associated with temperament or achievement.

Put another way, both emotional engagement and behavioral engagement are important for achievement, yet there is limited understanding as to how these two types of engagement may co-exist or be associated with one another in an early school setting. Indeed, (Ladd and colleagues 2000) found, among a diverse SES primarily Caucasian sample, that children's early emotional engagement was indirectly associated with achievement through behavioral engagement during kindergarten. These findings indicate that emotional engagement may be a precursor for behavioral engagement, such that if children feel emotionally connected to school they will actively participate at higher levels within the classroom. Importantly, predictors of engagement were not included in the examination of the proposed indirect chain effect, and, to our knowledge, this study is the only one that has examined this indirect chain effect during kindergarten. Moreover, whether the proposed chain model is evident among other kindergarten samples and when predictors (i.e., temperament traits) are included within the model is unknown.

Generally speaking, low-economic standing and minority group membership are common risk factors for school success (Entwisle & Alexander, 1999). Although most of the gap between Latino and ethnic-majority children's achievement can be explained by SES, Latino children underperform compared to their low-SES peers from ethnic-majority homes due to cultural and linguistic characteristics such as parenting activities, household resources, or language skills (Brooks-Gunn & Markman, 2005; Fryer & Levitt, 2006). Furthermore, it is important to examine normative developmental processes *among* Latino children. Notably, we aimed to examine the direct and indirect associations among temperament, engagement, and achievement across the transition to elementary school for a high-risk sample of Head Start largely Latino preschoolers.

The Present Study

We aimed to extend existing literature by testing a chain-like developmental process from preschool temperament (positive emotionality, anger, EC) to kindergarten emotional engagement to kindergarten behavioral engagement to kindergarten achievement. To account for possible differential associations involving temperament and to be consistent with previous research, we examined all paths from temperament to both types of engagement and from engagement to achievement. We hypothesized that positive emotionality and EC would be positively associated with, and anger would be negatively associated with, emotional engagement and behavioral engagement. In turn, we hypothesized that emotional engagement and behavioral engagement would be positively associated with achievement. We expected temperament to be indirectly associated with kindergarten achievement through emotional *and* behavioral engagement, and that indirect effects would be evident in a chain-like process from temperament to emotional engagement to behavioral engagement to achievement.

Method

Participants

Participants included 241 children (48% female, $n = 107$) and their teachers. At Wave 1, children were recruited from 18 Head Start preschools in a large, metropolitan Southwest city as part of a larger longitudinal study. The majority of the children were Latino (and specifically of Mexican/Mexican-American ethnic origin; 78%). Approximately 8% were non-Latino Caucasian, 7% identified as other, 6% of children were African American, and 1% were Native American. At the beginning of kindergarten, children's ages ranged from 4.75 to 6.00 years ($M = 5.44$ years; $SD = .42$ year). Parents reported on total family income, and 82% of households had a yearly income of less than \$30,000, though incomes ranged from less than \$10,000 (22% of sample) to more than \$60,000 (4.8% of sample). Overall, 45% of reporting parents were married, 22% were together but never married, 20% were single and never married, and 13% were separated/divorced/widowed. Of parent reporters, 26% did not complete high school, 28% completed high school only, 33% completed some vocational school or college, 10% graduated college, and 2% completed an advanced graduate degree.

At Wave 2 (a year later), the Head Start children were dispersed to 150 kindergarten classrooms across 36 elementary schools. Of the 241 children, 178 children had complete data in preschool and kindergarten. A total of 63 children had some missing data in kindergarten. Some reasons for missing data during kindergarten included families moving mid-semester and children refusing to complete achievement tests. *T*-tests showed that children for whom complete data were not available at both time points did not differ from the rest of the sample (children with complete data for both years) on family income, gender, age, temperament, or preschool achievement. We used a full information maximum likelihood estimator (ML) to handle missing data for the final sample.

Procedures

During Head Start, trained English-Spanish bilingual study personnel administered the Woodcock-Johnson Tests of Achievement III (WJ-III) in the spring semester to all children in their preferred language, English or Spanish. Preschool teachers' questionnaire packets were delivered to the teachers, and a member of the research team picked them up upon completion. Head Start classrooms fed into elementary schools and districts all over the city; thus, kindergarten teachers received questionnaire packets once parents identified the child's school and teacher. The parent, district, principal, and teacher provided consent. Teachers mailed the packets back to the researchers upon completion (97% return rate). Teachers reported on children's temperament and school engagement. Completion of the questionnaire took approximately 45 minutes and teachers were paid \$25 per child for their time.

Families came to lab-based follow-up visits during the spring of kindergarten, at which time children were administered the WJ-III achievement tests. Home visits were made for families who were unable to schedule a visit (2%). Families were paid \$40 for participating in follow-up visits and children received a small toy. All teacher report data were collected

during February and direct assessment data were collected during May of the preschool and kindergarten year.

Measures

Temperament.

Preschool teachers rated children's temperament using 40 items from the shortened version of the Children's Behavior Questionnaire (Rothbart et al., 2001). Questions were rated on a 5-point, Likert-type scale (1 = *Extremely false* to 5 = *Extremely true*). Four subscales were used in the current study. Two subscales tapped reactivity: smiling/laughter (e.g., "This child laughs a lot at jokes and silly happenings"; alpha from current sample = .83) and anger (e.g., "This child frequently becomes irritated when he/she makes a mistake"; alpha from current sample = .90). Two subscales tapped EC: attention focusing (e.g., "This child can lower his/her voice when asked to do so") and inhibitory control (e.g., "When picking up toys or doing other jobs, this child usually keeps at the task until it's done"). We created a mean composite of *effortful control* (i.e., attention focusing and inhibitory control; alpha = .90) for analyses. The CBQ has good internal consistency among teachers (alphas = .75-.89; Eisenberg et al., 2009).

School engagement.

Kindergarten teachers reported on school engagement using the Teacher Rating Scale of School Adjustment (Birch & Ladd, 1997; Ladd, et al., 1999), on a 3-point, Likert-type scale (1 = *Doesn't apply* to 3 = *Certainly applies*). The subscales have been shown to have good internal consistency (alphas range from .77 to .91; Buhs & Ladd, 2001).

Emotional engagement.—Emotional engagement was assessed with five items from the school liking subscale (e.g., "This child likes to come to school"; alpha = .874).

Behavioral engagement.—Cooperative participation (i.e., the extent to which the child is cooperative in the classroom; e.g., "This child follows teacher's directions") was assessed using seven items, and self-directedness (i.e., the extent to which the child works autonomously in the classroom; e.g., "This child is a self-directed child") was assessed using four items. A mean composite *behavioral engagement* score was created using the cooperative participation and self-directedness subscales, an approach that has been utilized in multiple studies (Ladd et al., 1999; Ladd & Dinella, 2009; Ladd et al., 2000), which showed high internal consistency (alpha = .92).

Academic achievement.

Children were assessed in the spring of preschool and kindergarten using three subscales from the WJ-III (Woodcock, McGrew, & Mather, 2001; Spanish equivalent, Bateria-III Woodcock-Muñoz; Muñoz-Sandoval, Woodcock, McGrew, & Mather, 2005)—Letter Word Identification (e.g., naming letters and reading words aloud from a list), Passage Comprehension (e.g., orally supplying the missing word removed from a sentence or very brief paragraph), and Applied Problems (e.g., mathematic word problems). In preschool, children were administered the subscales in their preferred language, English or Spanish, as

indicated by the child. In kindergarten, all children received the WJ-III subscales in English, consistent with standardized assessments in elementary school. Testing all children in English allowed us to understand how Head Start children were performing relative to the typical ways in which assessments are typically conducted in kindergarten— despite changing demographics, most standardized, content-based tests (such as math and reading) are written and administered in English (Abedi, 2002). We did, however, control for language preference in our analyses, because even when tests have been translated and administered in native language, non-English speaking students still perform lower than their English-speaking peers (Abedi&Dietel, 2004).

The WJ-III provides *W* scores (converted raw scores), which are a special transformation of the Rasch ability scale and were utilized in the current study because they are compatible across both versions of the test (i.e., English and Spanish). Muñoz-Sandoval et al. (2005) employed Item Response Theory methods with 2000 Spanish-speaking individuals and concluded that equal levels of competence were being measured by the English and Spanish assessments (Woodcock & Muñoz-Sandoval, 1993, 1996). The WJ-III and the Bateria-III are reliable and valid measures of achievement and yield comparable scores (WJ-III alphas = .91, .83, and .92 for letter word identification, passage comprehension, and applied problems respectively; Schrank, McGrew, Ruef, & Alvarado, 2005; Schrank, McGrew, & Woodcock, 2001).

Neither theory nor previous research led us to expect different associations among the three WJ-III subscales and the types of temperament or engagement. Accordingly, the subscales were reduced to a single composite indicator of academic achievement. The composite for WJ-III achievement was created by computing the mean *W* subscale scores for the three subscales. Furthermore, the WJ-III composite was adjusted (divided by 100) to be consistent with the scale of the other scales/composites.

Covariates.

Several demographic variables were included as covariates if they were significantly associated with study variables, including children's sex (*female* = 0, *male* = 1), language of academic assessment in preschool (*English* = 0, *Spanish* = 1), preferred language in kindergarten (*English* = 0, *Spanish* = 1), race/ethnicity (*not Mexican/Mexican American* = 0, *Mexican/Mexican American* = 1), and family income (range < \$10,000 to > \$140,000).

Classroom Effects

Because children were clustered within teacher/classroom during preschool, we examined the outcome variable, kindergarten achievement, for potential differences associated with preschool teacher/classroom. We calculated the classroom design effect (i.e., a function of the intraclass correlation and the average cluster size). A classroom effect greater than 2 indicates that the hierarchical nature of the data should be accounted-for in analyses (Muthén, 1994). The classroom effect (CE) for kindergarten achievement was below 2 (CE = 1.75), indicating that the kindergarten data were not meaningfully clustered within preschool teacher/classroom. Accordingly, we did not include preschool classroom in hypothesis tests.

Analytic Plan

Based on the Missing At Random (MAR) assumption (Enders, 2010), we estimated all models using a Full Information Maximum Likelihood (FIML) estimator using *Mplus 7* (Muthén&Muthén, 1998–2012). Though methods are not available to test the MAR assumption, it was believed to be reasonable for these data because no significant differences were found between participants with missing data and participants with complete data. We examined indirect effects using *Mplus'* MODEL INDIRECT command and obtained bias-corrected bootstrapped confidence intervals (5,000 bootstrap draws; MacKinnon, 2008). This procedure addresses the problem that indirect paths rarely follow a multivariate normal distribution by correcting estimates of standard errors for all parameters and confidence intervals (MacKinnon, 2008).

We assessed model fit using four fit indices: chi-square statistic (χ^2), the Standardized Root-Mean-Square Residual (SRMR), the Root-Mean-Square Error of Approximation (RMSEA), and the Comparative Fit Index (CFI). The chi-square statistic is a test for perfect fit. A significant chi-square test result indicates a poor fit (Kline, 2005). RMSEA and SRMR were used as measures of absolute fit, where scores below .08 typically indicate adequate fit and scores below .05 indicate good fit (Kline, 2005). The CFI was used to measure incremental fit, where a good fit is indicated if this score is above .95 (Kline, 2005).

Results

Preliminary Analyses

Descriptive statistics for study variables are presented in Table 1. For all variables except emotional engagement, skewness and kurtosis were low and did not indicate substantial deviations from normality (Tabachnick& Fidel, 2012). The slight deviation from normality for emotional engagement is not cause for concern, as bias-corrected bootstrapping, which was utilized in the hypothesized models, accounts for non-normality when computing standard errors. Next, we conducted repeated measures analyses of variance and follow-up analyses to examine differences in the study variables by children's sex, language of academic assessment in preschool, preferred language in kindergarten, and race/ethnicity. Given that significant, for categorical variables, differences emerged on and the continuous covariates were positively associated with almost all study variables we included the aforementioned variables as control variables in hypothesis tests.

We conducted Pearson product-moment correlations to examine zero-order correlations among the study variables and to determine whether child age and family income were associated with the study variables and should be considered as control variables. Many of the study variables were significantly correlated with one another from preschool to kindergarten or with covariates (Table 1). Following results showing significant correlations with achievement, children's age and family income were used as control variables in analyses testing the main study hypotheses. Standardized estimates showing the associations between control and study variables for the positive emotionality, anger, and EC models (STDYX for continuous predictors and STDY for categorical predictors) are presented in Table 2.

Hypothesis Test Results

In all models, kindergarten emotional engagement was positively associated with kindergarten behavioral engagement and, in turn, kindergarten behavioral engagement was positively associated with kindergarten achievement. In addition, the indirect effect of emotional engagement to achievement through behavioral engagement was supported (Table 3).

Preschool positive emotionality, kindergarten school engagement, and kindergarten academic achievement.

The model examining associations among preschool positive emotionality, kindergarten emotional and behavioral engagement, and kindergarten achievement had good fit: $\chi^2(3) = 2.25, p = .52$; CFI = 1.00; RMSEA = .00 [90% CI, .00, .10]; SRMR = .01. Positive emotionality was significantly associated with kindergarten behavioral engagement (Figure 1). Given that preschool positive emotionality was not significantly associated with kindergarten emotional engagement, the hypothesized chain process (preschool positive emotionality → kindergarten emotional engagement → kindergarten behavioral engagement → kindergarten academic) was not supported; however, an indirect effect of preschool positive emotionality on kindergarten achievement was supported, in which kindergarten achievement was predicted by preschool positive emotionality through kindergarten behavioral engagement (Table 3).

Preschool anger, kindergarten school engagement, and kindergarten academic achievement.

The model examining preschool anger as it associated with kindergarten achievement through kindergarten emotional and behavioral engagement also had good fit with the data: $\chi^2(3) = 2.04, p = .56$; CFI = 1.00; RMSEA = .00 [90% CI, .00, .09]; SRMR = .01. In this model (Figure 2), preschool anger was significantly associated with kindergarten emotional engagement and behavioral engagement and kindergarten achievement, and the hypothesized chain process was supported. Additionally, an indirect effect of preschool anger on kindergarten achievement was supported, in which kindergarten achievement was predicted by preschool anger through kindergarten behavioral engagement (Table 3).

Preschool effortful control, kindergarten school engagement, and kindergarten academic achievement.

The final model examining associations between preschool EC and kindergarten engagement and achievement also had adequate fit: $\chi^2(3) = 2.06, p = .56$; CFI = 1.00; RMSEA = .00 [90% CI, .00, .09] SRMR = .01. EC was significantly associated with kindergarten behavioral engagement but not emotional engagement (Figure 3). Thus, the hypothesized chain process was not supported. An indirect effect of preschool EC on kindergarten achievement was supported, in which kindergarten achievement was predicted by preschool EC through kindergarten behavioral engagement (Table 3).

Discussion

The transition to formal schooling is an important developmental period for children. The present study contributes to the relatively small, and somewhat inconsistent, body of literature examining school engagement as a mechanism linking temperamental reactivity and regulation to achievement. We extend existing evidence of this process by predicting to or from school engagement across the kindergarten transition and year. Specifically, this study, conducted with a sample comprised predominantly of Mexican/Mexican-American Head Start children, offers important evidence that behavioral engagement is a mechanism through which positive emotionality, anger, and EC are associated with kindergarten achievement. Preschool anger was negatively, and positive emotionality and EC were positively, associated with kindergarten behavioral engagement, even after accounting for children's sex, language of academic assessment in preschool, preferred language in kindergarten, age, income, and race/ethnicity. Only preschool anger was (negatively) associated with kindergarten emotional engagement. Behavioral engagement, but not emotional engagement, was directly positively associated with kindergarten achievement, *above and beyond* preschool academic achievement, children's sex, language of academic assessment in preschool, preferred language in kindergarten, and race/ethnicity. This study offers support that behavioral engagement is a mechanism through which temperament is related to kindergarten academic achievement as supported by significant indirect effects. To our knowledge, the present study is the first to examine these associations at the transition to school with the inclusion of both emotional engagement and behavioral engagement as separate constructs.

Direct Effects

Temperament to engagement.

In the present study, we observed a significant negative association between anger and both emotional engagement and behavioral engagement, consistent with existing literature (Diaz et al., 2015; Valiente et al., 2012). Children prone to anger may find less enjoyment in school, resulting in lower emotional engagement. In addition, children who have high levels of anger may be more likely to have conflict with others, resulting in low levels of cooperative behavior within the classroom.

Our findings extend some of the research that EC is associated with different types of school engagement (e.g., Iyer et al., 2010; Valiente et al., 2007): Here, preschool EC was positively associated with kindergarten behavioral engagement. Children who enter school with high levels of EC tend to demonstrate appropriate classroom behaviors, such as attending to the teacher and controlling negative emotions, and these behaviors are associated with behavioral engagement (Valiente et al., 2012). Existing evidence, as outlined in the introduction, indicates there are mixed findings regarding the association between EC and emotional engagement (Valiente et al., 2007; Valiente et al., 2012), and EC did not predict emotional engagement within the present study. One possibility for discrepant findings among studies may be differences in the ages or developmental stages of the participants. In the study conducted by Valiente and colleagues (2007), participants ranged from 7 to 12 years of age. Researchers were able to ask the students to report on their own EC and emotional engagement, an approach we could not utilize given that young children given

that children of this age struggle to accurately complete self-report measures (Fredricks & McCloskey, 2012). Allowing older students to report on their own emotional engagement may result in more congruency between engagement and achievement outcomes as older children may be more insightful; however, this approach may also result in children responding in ways that perceive to be socially desirable and, thus, may not fully reflect their own feelings. In addition, both of the studies conducted by (Valente and colleagues 2007; 2012), used measures of EC and emotional engagement that were concurrent. It may be that timing of the measures is another factor to consider regarding the association between EC and emotional engagement. Given that findings in the literature between EC and emotional engagement remain inconsistent, more research is necessary. In particular, researchers should examine EC as measured through different reporters and observational tasks at multiple timepoints.

Positive emotionality was positively associated with behavioral engagement. This finding is inconsistent with the limited previous research, which has shown no association between the aforementioned constructs (Diaz et al., 2016). In general, having a positive disposition may result in more cooperative and appropriate behavior within the classroom. For example, positive emotionality is important for motivation; it may be that by kindergarten, Latino children with high positive reactivity are more motivated to integrate into the social context at school, enhancing behavioral engagement (Rothbart & Hwang, 2005). However, the lack of previous research to support the link between positive emotionality and behavioral engagement highlights the need for more evidence across diverse samples. It is possible that the current study revealed a relation that is unique for low-SES Mexican/Mexican-American children.

As the present study only examined a measure of smiling/laughter, more research is necessary that examines different aspects of positive emotionality (e.g., sociability, dominance). It may be that a more nuanced operationalization of positive emotionality may help clarify discrepant findings for emotional versus behavioral engagement. It may not be sufficient to only examine positive emotionality in the absence of information regarding activation; for example, an emotion that is high in activation is excitement, whereas an emotion that is lower in activation is happiness or being relaxed (Pekrun & Linnenbrink-Garcia, 2012). It may be that positive emotionality is varied in levels of activation; smiling and laughter may be a more highly activating type of positive emotionality resulting in overt manifestations of engagement behavior, rather than less intense, covert feelings about school (Pekrun, Goetz, Titz, & Perry, 2002). Similarly, variation in children's self-regulatory abilities could moderate whether and when positive emotionality is important for engagement—or whether teachers perceive overtly positive students as engaged.

Engagement to academic achievement.

We found that behavioral but not emotional engagement was directly associated with kindergartners' achievement. This pattern of findings is consistent with few studies that have examined both types of engagement as separate constructs in university students (King & Gaellan, 2014) and in fifth-graders (Li, Lerner, & Lerner, 2010). Similarly, changes in behavioral engagement were stronger predictors, compared to changes in emotional

engagement, of children's achievement growth across the primary grades (Ladd & Dinella, 2009).

Considering the present findings in conjunction with the limited extant work, behavioral engagement seems to be a stronger determinant of children's achievement than their feelings of connectedness to school. This may not be entirely surprising, given that active, on-task behavior likely contributes to more involvement in and retention of material (and subsequent achievement) than merely how much students care about the material (or school) (Fredricks & McCloskey, 2012). Theoretical support exists for examining emotional and behavioral engagement as separate constructs (Fredricks et al., 2004) and, when examined concurrently, behavioral engagement, but not emotional engagement was associated with achievement. This finding begins to provide empirical support that complements theoretical support in the examination of emotional and behavioral engagement as separate constructs with implications for future research.

Indirect Effects

Anger and EC were indirectly associated with achievement through behavioral engagement, consistent with previous work across samples and grades (Kwon et al., 2016; Valiente et al., 2008; Valiente et al., 2014). Our findings extend existing work with models that account for the dependency between the two measures of engagement. In addition, to our knowledge, this is the first study to show an indirect association between positive emotionality and achievement through behavioral engagement.

The present study replicates and extends findings of a chain-like process involving similar constructs. Specifically, in previous work, emotional engagement was significantly associated with behavioral engagement, and behavioral engagement was significantly associated with achievement during kindergarten (Ladd et al., 2000). These findings are also consistent with previous work that has shown similar relations in older elementary children (Li et al., 2010). Furthermore, the indirect chain process from preschool anger to kindergarten achievement through emotional engagement and behavioral engagement was supported. The current study is the first to include predictors when examining this chain process during early elementary school, and show a supported indirect chain process. Importantly, given the many ways studies have conceptualized and measured positive emotionality and EC, we cannot dismiss them as predictors of emotional engagement until more research has been conducted during this critical transition period.

Overall, the present study makes a new contribution in beginning to disentangle how emotional and behavioral engagement act as possible mechanisms linking temperament and achievement. School engagement is malleable (Wang & Degol, 2014) thus can be targeted through prevention or intervention efforts. Because all three measures of temperament predicted behavioral engagement, which was associated with achievement beyond the effects of emotional engagement, it may be more time- and cost-effective to focus on increasing children's active involvement in the classroom than to focus on improving children's general feelings toward school.

Prevention/intervention efforts may also wish to target students' temperament, toward increasing their engagement and achievement. For instance, with older children, The Family Check-up (FCU) intervention has been useful. This program helps parents learn how to address child factors that may result in behavior problems and includes, among other things, temperament (Dishion et al., 2008). The FCU intervention has been found to increase children's self-regulation, which enhanced school engagement (Stormshak, Eosco, & Dishion, 2010). Families that participated in the FCU program during early childhood showed low levels of behavior problems and high levels of behavior control (Shelleby et al., 2012). These findings suggest that improving children's reactivity and regulation would have direct implications for behavioral engagement.

Strengths, Limitations, and Conclusions

Findings from the current study should be considered in the context of both strengths and limitations. First, we incorporated established, reliable, valid measures from multiple independent reporters to reduce common source variance. Specifically, temperament traits were rated by children's preschool teachers, emotional and behavioral engagement was rated by children's kindergarten teachers, and achievement was directly assessed. We incorporated teacher reports of temperament and engagement because we were interested in the school context across the transition from preschool to kindergarten, and to ensure reliability of the data, as young children may not be able to report on these measures reliably. Although different teachers reported on temperament and school engagement, we cannot ensure that shared method variance did not account for some magnitude of the associations between temperament predictors and school engagement. In addition, the complexity of the model precluded us from including all three temperament measures within the same model. Future research should examine how all three measures of temperament relate to both types of engagement within the same model. Further, future studies could extend the present findings by incorporating additional methods of assessment for the temperament or engagement measures (e.g., observational measures or parent-reported temperament). Still, teachers and parents have demonstrated congruence in reporting on these constructs for the same children (Eisenberg et al., 2009; Ladd et al., 2000), and our confidence in the present findings is strengthened by the inclusion of separate teacher reports and direct assessments in the overall models, as well as robust controls and modeling techniques. In addition, future research could extend our study by examining other aspects of both negative and positive emotionality within this process. Although beyond the scope of the present study, there are other preschool variables (i.e. relationships with peers and teachers, home context) likely associated with kindergarten engagement. Future research could extend the present study by simultaneously modeling temperament with other preschool experiences as predictors of school engagement.

One limitation in the timing of data collection is that both measures of kindergarten engagement, measured concurrently, were collected during the same semester as achievement. Existing literature suggests that emotional engagement is a precursor of behavioral engagement, and that engagement is a precursor of achievement; however, we cannot be certain our proposed direction of effects is complete given the timing of data collection; nor can we be certain that transactional or cascading effects might not be evident

with increased numbers of assessments over time (e.g., engagement predicts achievement, which predicts engagement, which predicts achievement, and so forth). Although not all variables were assessed longitudinally, achievement was examined at two time points. By controlling for preschool achievement when examining the associations between temperament traits and emotional and behavioral engagement for kindergarten achievement, we were able to assess how these factors were associated with achievement beyond children's preexisting academic skills. Future research should attempt to extend the current study by examining a model in which both emotional and behavioral engagement and achievement are measured at three different time points during kindergarten with the goal of better addressing the question of causality.

The characteristics of the sample is a strength of this study (i.e., approximately 80% low-SES, Mexican/Mexican American children recruited from Head Starts). In 2012, 24% of all U.S. children were Latino—a number projected to increase to 36% by 2050 (Federal Interagency Forum on Child and Family Statistics, 2013). The shift in the ethnic makeup of U.S. children highlights the need to understand mechanisms that promote achievement across the transition to formal school among ethnic minority students, particularly because of the substantial and persistent achievement gap between groups (Rathbun & West, 2004).

Even so, understanding the cultural/language processes associated with a successful transition to elementary school for Mexican/Mexican-American children is imperative (Fryer & Levitt, 2006; Hernandez, 2004). Unfortunately, teasing out the contributions that low SES and culture/language play in affecting Head Start children is difficult, especially in the current study. We identified and controlled for children's reported language preference; however, this presents limitations. For example, controlling for language preferences does not elucidate how children's language influences their school engagement and achievement. Thus, more culturally sensitive research that carefully examines language is needed to examine these processes between temperament, engagement, and achievement for dual-language learners.

The present study contributes to the existing literature through a focused investigation of the relations between both temperamental reactivity and regulation and different types of school engagement, an approach rarely utilized within the literature. We found that both reactivity and regulation emerged as precursors of children's behavioral engagement. Furthermore, our findings suggest that behavioral, but not emotional, engagement would seem to be the critical mechanism linking temperament and academic achievement during the early elementary grades. Overall, findings from the present study lend support for intervention approaches that target temperament, with a goal of appropriately modifying children's regulation and reactivity, which, in turn, has direct implications for increased classroom participation and on-task behavior, with the ultimate goal of increased achievement. Intervening during early elementary school may provide children with the skills necessary to promote not only early academic success, but also skills needed for continued success throughout their academic career.

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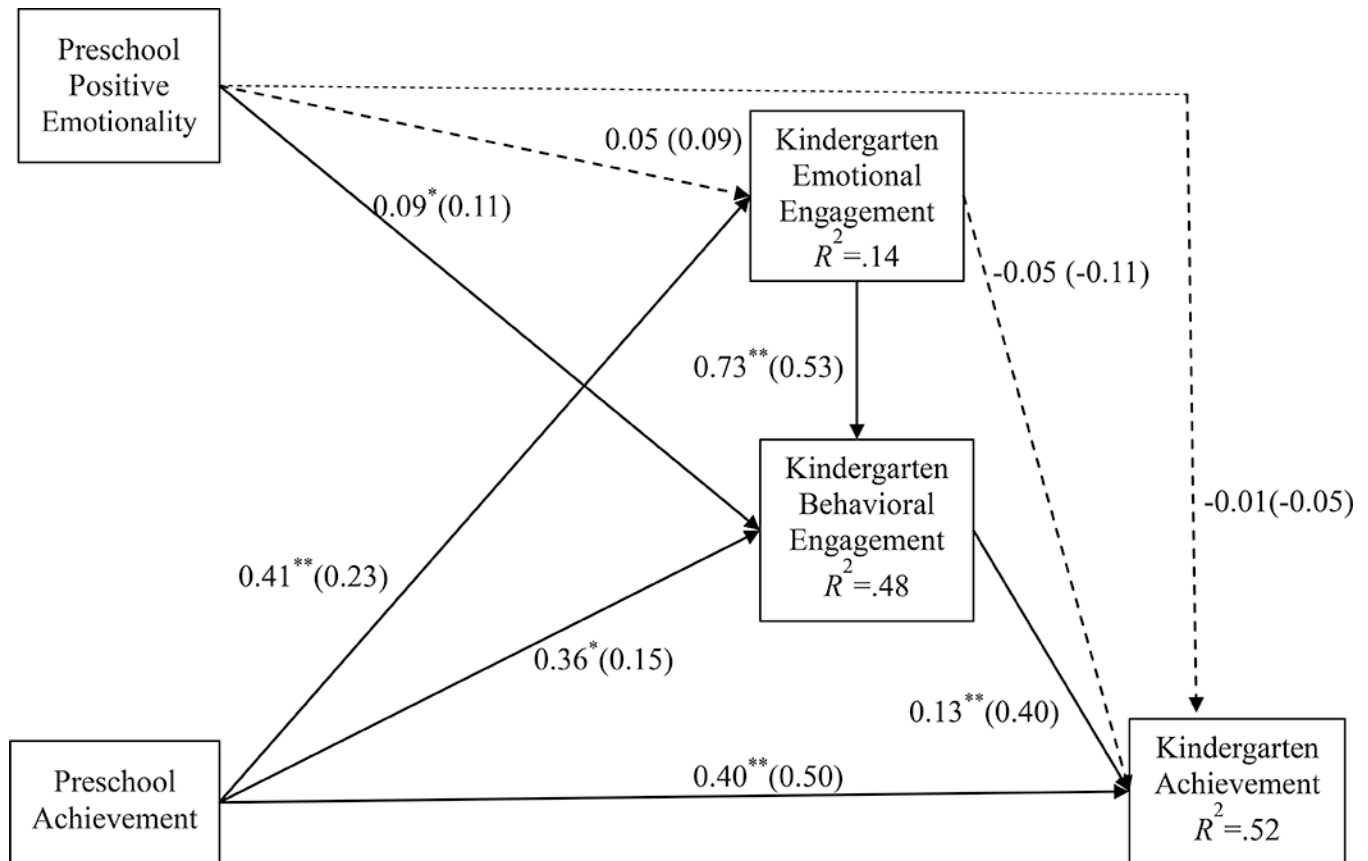


Figure 1.

Path model depicting paths from preschool positive emotionality to kindergarten emotional engagement and behavioral school engagement to kindergarten achievement. Model fit: $\chi^2(3) = 2.25, p = .52$; Comparative Fit Index (CFI) = 1.00; root mean square error of approximation (RMSEA) = .00 standardized root mean square residual (SRMR) = .01. The model was estimated using 5,000 bias-corrected bootstrap samples. Unstandardized estimates are followed by standardized estimates in parentheses. Estimates for covariates can be found in Table 3. Solid lines indicate significant paths; dashed lines indicate non-significant paths. Covariances among preschool and kindergarten variables were included in the final model but not depicted for readability. * $p < .05$, ** $p < .01$.

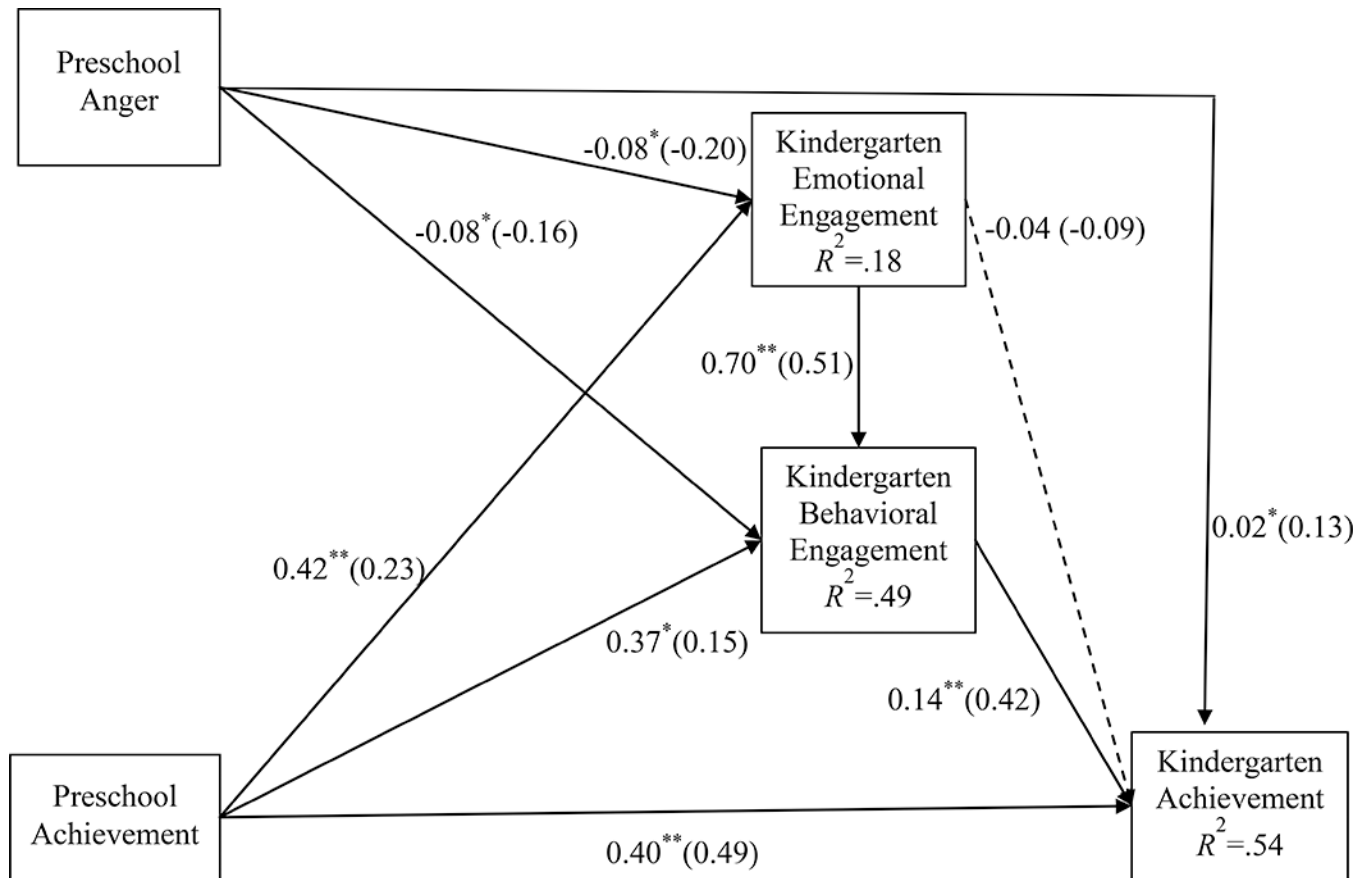


Figure 2. Path model depicting paths from preschool anger to kindergarten emotional engagement and behavioral school engagement to kindergarten achievement. Model fit: $\chi^2(3) = 2.04, p = .56$; Comparative Fit Index (CFI) = 1.00; root mean square error of approximation (RMSEA) = .00; standardized root mean square residual (SRMR) = .01. The model was estimated using 5000 bias-corrected bootstrap samples. Unstandardized estimates are followed by standardized estimates in parentheses. Estimates for covariates can be found in Table 3. Solid lines indicate significant paths; dotted lines indicate non-significant paths. Covariances among preschool and kindergarten variables were included in the final model but not depicted for readability. * $p < .05$, ** $p < .01$.

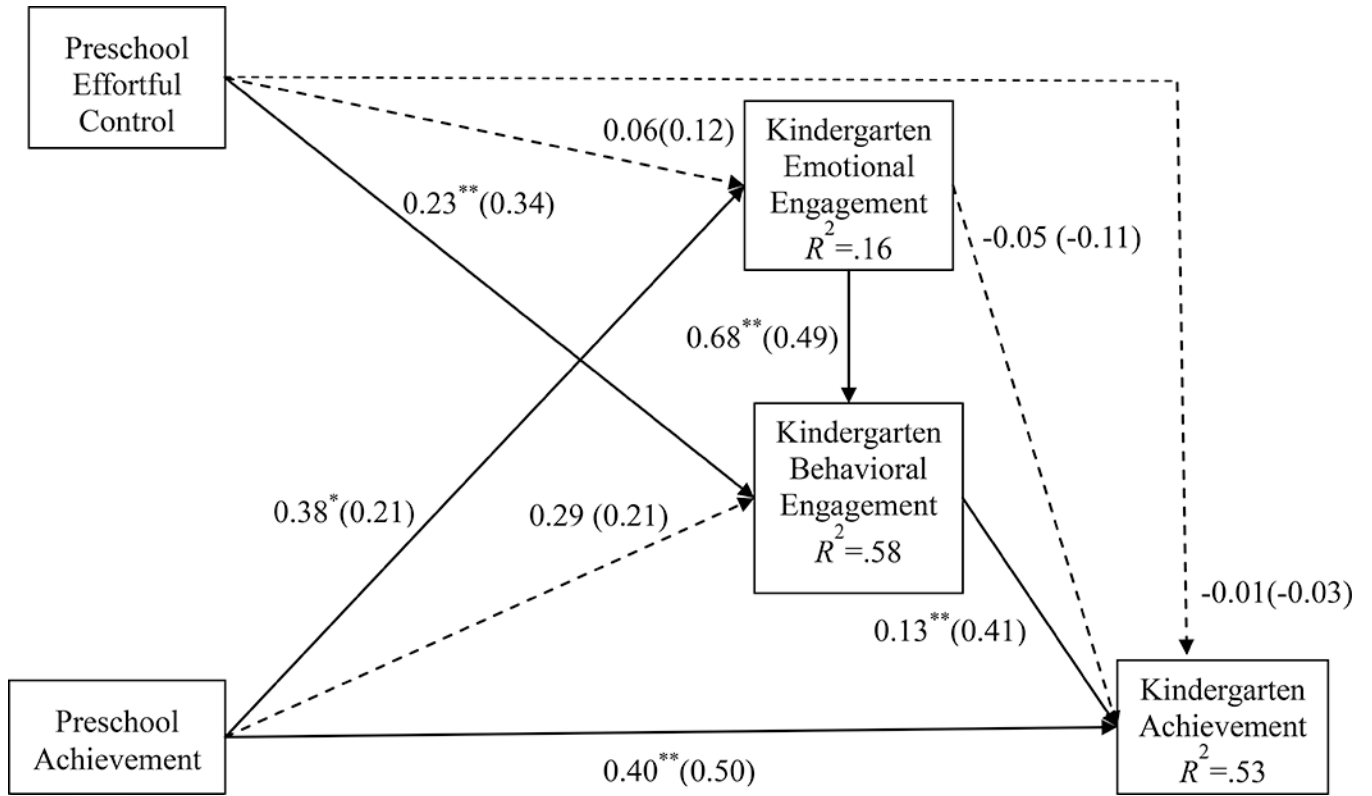


Figure 3. Path model depicting paths from preschool effortful control to kindergarten emotional engagement and behavioral school engagement to kindergarten achievement. Model fit: $\chi^2(3) = 2.06, p = .56$; Comparative Fit Index (CFI) = 1.00; root mean square error of approximation (RMSEA) = .00; standardized root mean square residual (SRMR) = .01. The model was estimated using 5000 bias-corrected bootstrap samples. Unstandardized estimates are followed by standardized estimates in parentheses. Estimates for covariates can be found in Table 3. Solid lines indicate significant paths; dotted lines indicate non-significant paths. Covariances among preschool and kindergarten variables were included in the final model but not depicted for readability. * $p < .05$, ** $p < .01$.

Table 1

Descriptive Statistics and Zero-order Correlations for Study Variables and Control Variables

	1	2	3	4	5	6	7	Child Age	Family Income
Wave 1 - Preschool									
1 Positive Emotionality	-							-0.04	0.06
2 Anger	-0.15*	-						0.08	0.00
3 Effortful Control	0.17**	-0.66**	-					-0.03	0.06
4 Academic Achievement	-0.05	0.00	0.18**	-				0.24**	0.26**
Wave 2 - Kindergarten									
5 Emotional Engagement ^a	0.08	-0.24***	0.17*	0.10	-			-0.01	-0.09
6 Behavioral Engagement	0.16*	-0.35**	0.46**	0.19**	0.59**	-		0.04	-0.02
7 Academic Achievement	-0.05	0.06	0.20**	0.62**	0.11*	0.33**	-	0.15*	0.17*
Mean	4.01	2.42	3.61	371.18	2.81	2.43	405.19	5.44	--
Standard Deviation	0.59	0.93	0.71	19.44	0.35	0.24	15.18	0.42	--
Minimum	2.00	1.00	1.94	283.67	1.20	1.00	341.00	4.75	<\$10,000.00
Maximum	5.00	4.80	4.83	417.00	3.00	3.00	453.00	6.00	\$70,000.00 - \$80,000.00
Skew	-0.64	0.36	-0.42	-0.89	-2.03	-0.87	0.06	-0.20	--
Kurtosis	0.83	-0.61	-0.74	1.70	3.83	0.15	1.88	-0.76	--

Note. Degrees of freedom for correlations ranged from 165–235.

* $p < .05$

** $p < .01$

*** $p < .001$.

^aBecause emotional engagement had higher than desired skew, Spearman correlations among emotional engagement and other variables are presented. All other correlations are Pearson Product Moment correlations. The original achievement scores are presented; however, for all analyses, achievement scores were divided by 100 to ease model convergence.

Table 2

Standardized Partial Regression Coefficients between Control and Study Variables

	Emotional Engagement	Behavioral Engagement	Academic Achievement	
	W2	W2	W1	W2
	β	β	β	β
Gender	0.20 *	0.13 *	-	0.00
Age	0.01	0.08	-	-0.04
Language of Preschool Assessment	-	-	-0.36 **	-
Preferred Language in Kindergarten	0.07	0.20 **	-	-0.18 **
Ethnicity	0.23 *	0.09	-	-0.15 *
Family Income	-0.09	0.05	-	0.02

Note. Study variables were regressed according to preliminary analyses upon child gender (*female* = 0, *male* = 1), age, initial verbal ability, language of preschool assessment (*English* = 0, *Spanish* = 1), preferred language in kindergarten (*English* = 0, *Spanish* = 1), ethnicity (*not Mexican/Mexican American* = 0, *Mexican/Mexican American* = 1), and family income. Dashes (–) indicate that the paths were not estimated. All covariates were allowed to covary. W1=Preschool. W2 = Kindergarten. β = standardized beta estimates [STDYX for continuous predictors and STDY for categorical predictors].

* $p < .05$

** $p < .01$.

Table 3

Bias-Corrected Bootstrap 95% Confidence Intervals for all Indirect Effects

Indirect Effect	Parameter Estimate (SE) [LCI, UCI]
<u>Emotional engagement</u>	
Positive Emotionality → Emotional engagement → Achievement	-0.001 (0.003) [-0.011, 0.002]
Anger → Emotional engagement → Achievement	0.003 (0.003) [0.001, 0.010] *
EC → Emotional engagement → Achievement	-0.003 (0.003) [-0.012, 0.001]
<u>Behavioral Engagement</u>	
Positive Emotionality → Behavioral Engagement → Achievement	0.012 (0.006) [0.002, 0.026] *
Anger → Behavioral Engagement → Achievement	-0.011 (0.005) [-0.023, -0.002] *
EC → Behavioral Engagement → Achievement	0.030 (0.008) [0.016, 0.050] *
<u>Hypothesized Chain Indirect Effect</u>	
Emotional engagement → Behavioral Engagement → Achievement	0.095 (0.022) [0.058, 0.143] *
Positive Emotionality → Emotional engagement → Behavioral Engagement → Achievement	0.003 (0.004) [-0.004, 0.013]
Anger → Emotional engagement → Behavioral Engagement → Achievement	-0.007 (0.003) [-0.015, -0.002] *
EC → Emotional engagement → Behavioral Engagement → Achievement	0.005 (0.004) [-0.001, 0.014]

Note.

* indicates the indirect effect does not contain zero and the indirect effect is supported. Unstandardized parameter estimates are followed by the standard errors (SE) in parentheses. The 95% bias-corrected CI for each indirect effect is in brackets [lower confidence interval, upper confidence interval]