

UC Davis

UC Davis Previously Published Works

Title

Relations of positive and negative expressivity and effortful control to kindergarteners' student-teacher relationship, academic engagement, and externalizing problems at school

Permalink

<https://escholarship.org/uc/item/4z52f900>

Authors

Diaz, Anjolie
Eisenberg, Nancy
Valiente, Carlos
et al.

Publication Date

2017-04-01

DOI

10.1016/j.jrp.2015.11.002

Peer reviewed



Published in final edited form as:

J Res Pers. 2017 April ; 67: 3–14. doi:10.1016/j.jrp.2015.11.002.

Relations of Positive and Negative Expressivity and Effortful Control to Kindergarteners' Student-Teacher Relationship, Academic Engagement, and Externalizing Problems at School

Anjolie Diaz^{1,a}, Nancy Eisenberg², Carlos Valiente¹, Sarah VanSchyndel², Tracy L. Spinrad¹, Rebecca Berger¹, Maciel M. Hernandez², Kassondra M. Silva¹, and Jody Southworth¹

¹T. Denny Sanford School of Social and Family Dynamics, Arizona State University, 850 S. Cady Mall Tempe, AZ 85281-3701 USA

²Department of Psychology, Arizona State University, P.O. Box 871104, Tempe, AZ 85287-1104 USA

Abstract

The current study examined the role of naturally-occurring negative and positive emotion expressivity in kindergarten and children's effortful control (EC) on their relationships with teachers, academic engagement, and problems behaviors in school. Further, the potential moderating role of EC on these important school outcomes was assessed. Emotion and engagement were observed at school. EC was assessed by multiple methods. Teachers reported on their student-teacher relationships and student's externalizing behaviors. Children's emotion expressivity and EC were related to engagement and relationships with teachers as well as behavioral problems at school. Children low in EC may be particularly vulnerable to the poor outcomes associated with relatively intense emotion expressivity as they struggle to manage their emotions and behaviors in the classroom.

Keywords

Behavioral problems; Effortful control; Emotion; Academic engagement; Student-Teacher relationships; Temperament

1. Introduction

The frequency and intensity with which children express positive and negative emotions are thought to contribute to their social functioning (Eisenberg, Fabes, Bernzweig, Karbon, Poulin, & Hanish, 1993), as well as their motivation and participation in school (Pekrun, 2006). Additionally, intense emotional reactivity and/or expressivity, especially of negative

Correspondence concerning this article should be addressed to Dr. Nancy Eisenberg, Department of Psychology, Arizona State University, P.O. Box 871104, Tempe, AZ 85287-1104. Phone: (480) 965-5217 nancy.eisenberg@asu.edu.

^aPresent address: Department of Psychological Sciences, Ball State University, Muncie, IN 47306

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

emotions, has been linked to problem behaviors (e.g., Rothbart, Ahadi, & Hershey, 1994; Eisenberg, Fabes, et al., 1996) that are believed to undermine early school performance (Bub, McCartney, & Willet, 2007; Bulotsky-Shearer & Fantuzzo, 2010). However, whether emotions and their expression are associated with school outcomes may depend on children's temperamental (dispositional) self-regulation, that is, their effortful control (EC). Effortful control is "the ability to inhibit a dominant response and/or to activate a subdominant response, to plan, and to detect errors" (Rothbart & Bates, 2006, p. 129). There is a strong body of literature suggesting that EC is related to children's positive school adjustment, including classroom participation, quality of relationships with teachers and externalizing behaviors (Eisenberg, Spinrad, Eggum, 2010; Graziano, Reavis, Keane, & Calkins, 2007; Kim, Nordling, Yoon, Boldt, & Kochanska, 2012; Valiente, Lemery-Chalfant, Swanson, & Reiser, 2008). However, to our knowledge, no researchers have assessed how extensive observations of children's emotions expressed at school relate to school-related outcomes during kindergarten. Thus, in the current study, we examined the role of negative and positive emotion expressivity and EC (assessed with multiple methods and reporters) on children's interpersonal relationships with teachers, observed engagement in the classroom, and problems behaviors at school. Consistent with Rothbart and Bates' (1998, 2006) discussion of the importance of considering temperament by temperament interactions, especially those involving the reactive and control systems, we also examined whether children's EC moderated the relations of both positive and negative expressivity to school outcomes.

The quality of children's relationships with their teachers and their engagement at school, as well as their ability to refrain from disruptive behavior in the classroom, are relevant for academic success when children enter the school environment. For instance, both student-teacher relationship quality and early classroom participation have positive concurrent and prospective relations to children's academic achievement (Hamre & Pianta, 2001; Ladd & Dinella, 2009; Valiente et al., 2008). Additionally, externalizing behavior is characterized by a constellation of disorderly behaviors believed to compromise academic outcomes including reading and math as well as adjustment at school (Hindshaw, 1992; Metsäpelto et al., 2015; Masten et al., 2005).

Children's temperament may be an important factor in understanding school-related outcomes. Temperament is comprised of 'constitutionally based individual differences in reactivity and self-regulation' (Rothbart & Bates, 2006, p. 100). Reactivity refers to the degree of arousability, responsiveness, and excitability of motor, affective, and sensory response systems (Rothbart & Bates, 1998). Reactivity includes general patterns of behaviors and the overall tendency to express negative (i.e., fear, anger, and frustration) or positive emotionality (i.e., smiling, sociability, and high intensity pleasure; Putnam, Rothbart, & Gartstein, 2008). Self-regulation, on the other hand, refers to capacities or processes like EC that function to modulate reactivity by decreasing or increasing the onset, intensity, or duration of temperamental reactions (Rothbart et al., 2006).

Temperamental reactivity and regulation are believed to be fundamental for understanding social and personality development (Rothbart, et al., 1994). A growing body of research suggests that temperament may also facilitate or impede learning strategies and processes

(Davis & Carr, 2002; Orth & Martin, 1994), extending temperament's potential effects further into the school context. Indeed, temperament may be associated with children's reactions to the school environment and contribute to variability in the quality of emerging interpersonal relationships at school (Keogh, 2003; Valiente et al., 2008). Several studies have provided evidence for the critical role of EC for school readiness and adjustment (Raver, 2002; Raver, Garner, & Smith-Donald, 2007). However, little attention has been paid to the potential role of both positive and negative emotion in young children's school success (Keogh, 2003). Therefore, the goal of the present study was to examine how negative and positive emotional expressivity and self-regulation (EC) relate to student-teacher relationship quality, academic engagement, and behavioral problems in kindergarten. The second goal was to examine the potential moderating role of children's EC on the relation between emotion expressivity and these important school outcomes.

1.1 Reactive Temperament: Negative and Positive Expressed Emotion

Frequent and relatively intense expressions of negative emotion were expected to undermine children's school outcomes for a variety of reasons. Strong negative emotion reactivity and expressivity, such as becoming angry when the teacher points out a mistake, or becoming sad and withdrawn when corrected, can interfere with remembering information, motivation, and even test performance at school (Raver, 2002; Raver et al., 2007). Moreover, children prone to negative emotion expressivity may encounter more challenges developing and maintaining higher quality relationships (Pianta, Cox, & Snow, 2007). Consistent with this idea, negative emotion has been associated with poorer relationships with teachers, particularly conflictual student-teacher relationships, and with lower student-teacher closeness in both preschool and elementary school (Ladd & Burgess, 1999; Sette, Baumgartner, & Schneider, 2014; Valiente, Swanson, & Lemery-Chalfant, 2012). Such findings are important because student-teacher relationships characterized by warmth/closeness and/or low conflict have been positively associated with children's achievement, motivation, and academic readiness (Ladd, Birch & Buhs, 1999; Liew, Chen & Hughes, 2010). However, significant relations between children's emotions and school-related outcomes have not always been obtained; for example, in a study with older children and adolescents, self-reports of negative emotion did not uniquely predict student-teacher relationship quality (Lewis, Huebner, Reschly, & Valois, 2009).

A majority of studies examining the relations of emotion to the quality of student-teacher relationships rely on adults' reports or self-reports of emotion. However, the reliance on questionnaires has been criticized on the basis that reports may be biased (e.g., reporters try to present the child or the self in a positive light, inaccurate memory). Evidence of bias is provided by studies that have found high correspondence between mothers' and observers' temperament ratings of unknown children but low correspondence when ratings involved mothers' own children (Seifer, Sameroff, Dickstein, Schiller, & Hayden, 2004; Stifter, Willoughby, & Towe-Goodman, 2008).

Direct observation of children's temperament is thought to reduce some of the bias associated with questionnaire methods by allowing coder objectivity and by increasing ecological validity (Kagan, 1994). Both theoretical and empirical papers suggest that it is

desirable to utilize multiple observations of a construct whenever possible, both as a means of increasing the stability of findings and as a way of minimizing non-representative responding due to the presence of an observer (Kagan, Snidman, McManis, Woodward, & Hardway, 2002; Majdandži, & Van Den Boom, 2007; Rothbart, Chew, & Gartstein, 2001). Moreover, naturalistic observations of emotion expressivity at school may provide a better predictor of school-related outcomes. Emotions expressed at school are embedded in the school context and, thus, reflect appropriateness in regard to within-context expectations that children encounter on a regular basis. In the present study, emotion expressivity observed over months across various school contexts were used as markers of temperamental reactivity.

Children's emotion expressivity may also be relevant to their academic engagement, which is a vital component in their academic performance (Pekrun & Linnenbrink-Garcia, 2012). Academic engagement is comprised of several behaviors, including children's effort, participation, and ability to follow instructions (Fredricks & McColskey, 2012). According to the Control-Value of Achievement Emotions theory, expression of negative emotion undercuts students' effort, motivation, and enjoyment of school (Linnenbrink, 2007; Pekrun, 2006). Children who are low in academic engagement, compared to more engaged classmates, likely find it more difficult to follow rules and instructions as well as to focus on learning opportunities (Valiente et al., 2012). Although there is little empirical research regarding the role of negative emotion expressivity in academic engagement, Valiente and colleagues (2012) found a negative relation between children's adult-reported negative emotion and adult-reported classroom participation in kindergarteners.

Negative emotion and its expression are important factors in understanding externalizing problems at school (Diener & Kim, 2004; Eisenberg et al., 2010; Eisenberg, Fabes, et al., 1996). The presence of behavioral problems in early childhood is thought to be associated with an array of later negative outcomes, including antisocial behavior (Campbell, Spieker, Burchinal, Poe, & NICHD ECCRN, 2006) and academic underachievement (Hinshaw, 1992). Children who exhibit more negative emotion tend to exhibit higher levels of aggression and non-constructive behaviors and fewer prosocial behaviors than their less negative peers (Diener & Kim, 2004; Eisenberg, Fabes, Nyman, Bernzweig, & Pinuelas, 1994) and, likely experience difficulties appropriately engaging in class and in forming close relationships with their teachers.

Most of the limited evidence pertaining to the relations of children's emotion reactivity or expressivity to school relationships, academic engagement, and problem behavior has focused on negative emotion. In contrast to negative emotion, positive emotion might be expected to relate to positive adjustment at school (Perkun, Goetz, Titz, & Perry, 2002). Expressing positive emotions may assist in the development of social relationships including those with teachers, as well as in the initiation and regulation of social exchanges (Denham, 1998). It may also be related to the degree of motivation and engagement at school (Valiente et al., 2012). However, researchers have reported mixed evidence regarding the extent to which positive emotions and their expression predict the student-teacher relationship, with some researchers finding a positive association in older children and adolescents (Lewis et al., 2009; Reschly, Huebner, Appleton, & Antaramian, 2008) and others reporting no

associations between positive emotionality and the quality of relationships with teachers in Kindergarten (Ladd et al., 1999).

What research is available for positive emotion suggests that it relates to greater academic engagement (Pekrun & Linnenbrink-Garcia, 2012; Reschly et al., 2008). Perkmun et al. (2012) argued that positive emotions enhances motivation, facilitates elaborate information processing, and directs attention towards task performance. Moreover, according to the Broaden and Build Theory (Fredrickson, 2001), the extent that positive emotions promote the aforementioned skills should enhance coping skills as well as greater resiliency to adversity, which may include protection against the development of behavior problems (Conway & McDonough, 2006). Indeed, positive emotion has been negatively related to externalizing behaviors (Kim, Walden, Harris, Karrass, & Catron, 2007). However, it should be noted, that intense positive emotion has been related to greater problem behaviors and lower prosocial behaviors in elementary school children (Eisenberg, Fabes, et al., 1996; Rydell, Berlin, & Bohlin, 2003), perhaps because intense positive expressivity has sometimes been related to low EC and may reflect low self-regulation (Kochanska, Murray, & Harlan, 2000). Furthermore, the construct of positive emotion can be conceived as 'activation,' incorporating both positive emotion and energetic approaches to social situations (Rothbart & Bates 2006). Recent studies suggest that the inclusion of activity as a facet of positive emotion may act as an additional but weaker predictor of externalizing problems, especially in the general population (De Pauw, Mervielde, & Van Leeuwen, 2009; Mervielde, De Clercq, De Fruyt, & Van Leeuwen, 2005). Differences in the operationalization of positive emotion may explain discrepancies across studies (Tackett, Kushner, Fruyt & Mervielde, 2013).

1.2 Effortful Control

EC is composed of a set of temperamentally based characteristics that reflect an individual's ability to willfully modulate thoughts, emotions, and behavior. Specifically, EC involves the abilities to withhold a dominant response in order to perform a non-dominant (e.g., non-preferred) response (inhibitory control), to activate a non-dominant response (activation control), and to shift and focus attention as needed to adapt and accomplish goals (Rothbart & Bates, 2006).

The growth of self-regulatory mechanisms is viewed as the cornerstone of childhood development (Shonkoff & Phillips, 2000). The abilities to willfully or voluntarily inhibit, activate, and change behaviors are believed to be especially important in the classroom where sitting for long periods of time, paying attention, following instructions, and ignoring distractions are necessary to limit class disruptions, learn, and form positive teacher relationships. Children with greater EC are more compliant with requests than are less regulated peers (Spinrad et al., 2012), so they should be better able to follow teachers' instructions and comply with expectations. In addition, EC provides a means of controlling emotion and, in doing so, would be expected to reduce negative social and emotional interactions that can affect student-teacher closeness and confrontations. Indeed, preschoolers' (Silva et al., 2011) and first graders' (Rudasill & Rimm-Kaufman, 2009) EC

has been positively associated with close and low-conflict relationships with teachers, albeit not in all relevant studies (e.g., Liew et al., 2010).

Children with greater EC may also be more involved in learning activities. At school, children need to manage their behavior as well as the demands associated with school work. Children with low EC may have difficulties with these tasks leading to frustration and withdrawal as well as dissatisfaction with school. Valiente and colleagues (2007) suggested that children with greater EC have greater feelings of inclusion due to better relationships at school, and greater involvement in the classroom and at school. In empirical studies, children's EC has been positively related to participation (e.g., items on following instructions, the degree to which the child challenges him/herself, and self-direction in the classroom; Silva et al., 2011; Valiente et al., 2008). Nevertheless, to our knowledge, no researcher has examined the relation of EC to observed academic engagement in the classroom, especially during the kindergarten transition—a time when adults' expectations change rapidly and children must adjust to new contexts and demands (Rimm-Kaufman & Pianta, 2000). Extensive observations of engagement in the classroom may be less biased measures of the consistency and persistence of kindergarteners' academic engagement behaviors than are adults' reports of engagement (Fredricks & McColskey, 2012).

Overall, there is a growing body of research suggesting the critical role of EC in socially competent behavior and the development of behavior problems (Eisenberg et al., 2010, 2000; Kim et al, 2012). Individuals who can regulate their behavior are more likely to express socially appropriate emotions and to behave in appropriate ways (Eisenberg et al., 2000; Kochanska et al., 2000). Conversely, children who are low in EC tend to be at greater risk for a broad range of externalizing behaviors (Kim et al, 2012; see Eisenberg et al., 2010). Thus, there is reason to expect EC to be inversely related to teachers' reports of problem behavior at school.

1.3 Prediction from the Interaction of EC and Emotionality

Although Rothbart and Bates (1998) discussed the importance of considering temperament by temperament interactions, especially those involving the reactive and EC systems, little attention has been paid to this line of research for school-related outcomes. Researchers have found interactions between parent- and teacher-rated negative emotionality and EC when predicting school-age children's social competence and maladjustment (Eisenberg et al., 2000, Valiente et al., 2003). Typically, EC tends to be more strongly related to social competence/maladjustment for children high in negative emotion, perhaps because of their greater need to modulate emotion and its expression (Eisenberg et al., 2000, Valiente et al., 2003). However, Belsky et al., (2001) found no significant interaction between a laboratory assessment of negative emotion and EC when predicting parent reported problem behaviors. Perhaps because unlike previous studies, children's negative emotionality was not related to externalizing behaviors in this sample. Studies with 3- to 8-year olds have also found no significant interactions between parent reported negative emotion and either reported or lab assessed EC when predicting children's problem behaviors (Olson, Sameroff, Kerr, Lopez, & Wellman, 2005; Rydell et al., 2003), not necessarily exhibited in the school context.

Valiente and colleagues (2012) were among the few researchers to investigate such relations in a sample of 291 kindergarteners and found that reported anger was negatively related to the quality of the student–teacher relationship at low and moderate, but not high, levels of reported EC. When predicting math and reading achievement in the same sample, Valiente et al. (2010) found a somewhat different pattern: Adult-reported sadness and anger were negatively related to math and reading achievement for children high and moderate in reported EC, but not low EC (those low in EC were consistently low in achievement). When both teachers' and parents' reports of the same emotion were entered together in the same model, there was only evidence of moderation for teacher-reported negative emotion. In marked contrast to most other findings, in a large sample of over one thousand children, Belsky et al (2001) found that high negative emotionality assessed at 15 months positively predicted school readiness at 36 months (children's knowledge of color, letter identification, number/counting, comparisons, and shape recognition) for children high in attentional control. This study utilized a measure of attentional persistence during object play as a marker of attentional control processes. Thus, the pattern of findings in regard to the interaction of children's EC and negative emotion expressivity is not very consistent and seems dependent on the type of outcome, the measure of EC and perhaps the sample size. Moreover, most of the existing studies involve adult-reported or a brief laboratory task rather than observed negative emotionality.

There is much less research on the interaction of positive emotionality with EC when predicting outcomes in the academic domain (or even more broadly). In a sample of 151 5- to 8-year olds, Rydell et al. (2003) found that children who exhibited low levels of positive emotionality or exuberance, in comparison to more positive/exuberant children, demonstrated lower levels of externalizing problems levels regardless of their regulation. In contrast, among children with high levels of positive emotion-exuberance, there was a negative relation between regulators and externalizing problems. Work with different age groups and larger samples might, however, result in a different pattern of findings.

1.4 The Present Study

In the present study, we examined the relations of observed negative and positive emotion expressivity at school and EC to the quality of student-teacher relationships, academic engagement, and externalizing problem behaviors in school. In most existing research on these topics, emotionality (and engagement) have been assessed with adult- or self-reports rather than naturalistic observations. To our knowledge, this is the first study to assess how children's naturally occurring emotions observed in the school context relate to these school-related outcomes during the course of kindergarten. EC and emotion expressivity were measured early in the school year and all school outcomes were assessed later in the same academic school year.

Based on the bulk of prior findings and for conceptual reasons, we predicted that children's negative emotion expressivity would positively predict both student-teacher conflict (Ladd & Burgess, 1999; Sette et al., 2014; Valiente et al., 2012) and externalizing behaviors (Diener & Kim, 2004; Eisenberger et al., 1994) and negatively predict teacher-student closeness Ladd, Birch & Buhs, 1999; Liew, Chen & Hughes, 2010) and engagement (Linnenbrink, 2007;

Pekrun, 2006). In contrast, positive expressivity and EC were expected to predict greater engagement (Pekrun et al., 2002, Valiente et al., 2012), and teacher-student closeness and less student-teacher conflict (Reschly et al., 2008), and fewer externalizing behaviors (Eisenberg et al., 2010, 2000; Kim et al., 2007). Due to some previous work (Valiente et al., 2012), we expected EC to moderate the relations between negative emotion and each outcome, such that the negative relation to academic engagement and the positive associations with poor student-teacher relationship and behavioral problems would be most pronounced at low levels of EC. We did not predict a positive relation between negative emotion and poor school outcomes at high levels of EC. We did not have a clear hypothesis regarding interactions between positive emotion and EC when predicting outcomes, but it seemed plausible that the relation of positive emotion to school outcomes would be strongest for children high in EC (Kochanska et al., 2000).

In addition, we controlled for children's age, ethnicity, sex, and family socioeconomic status (SES) because of their relations to school outcomes (Bingham & Okagaki, 2012; Eisenberg, Martin, & Fabes, 1996; Hamre & Pianta, 2001). Because natural observations of children's emotion expressivity were observed during classes, lunch, and recess, the percent of observations in classrooms versus other school settings was also controlled for to account for possible differences in emotion expression by school context.

2. Method

2.1 Participants

Participants included three hundred and one kindergarteners (52% girls; $M = 65.72$ months, $SD = 4.18$, range from 51 to 82 months; 52.80% Hispanic, 34.20% White, 2.70% Asian, 2.00% American Indian/Alaska Native backgrounds, 2.00% Black, .70% other, and 5.60% unknown) from 26 classrooms across five schools in a southwestern U.S. metropolitan area. Children were recruited at the beginning of the school year and two cohorts ($n = 178$ and 123) participated one year apart. Recruitment included nearly equal numbers of boys and girls and ethnicity distributions that were similar to these schools. Parents who reported their education (296 mothers, 294 fathers) varied in educational attainment (11.2% of mothers and 17% of fathers did not complete high school, 18.6% of mothers and 21.8% of fathers held a high school degree or equivalent, 30.7% of mothers and 24.5% of fathers completed some college, and 39.5% of mothers and 36.7% of fathers had a college degree or higher). The average household income was between \$50,000 to \$69,999 (ranging from less than \$9,999 to more than \$100,000).

2.2 Procedures

Data were obtained from naturalistic observations of children's academic engagement and positive and negative emotions at school, observer ratings, a behavioral task at school, and parents' and teachers' ratings of children's EC, and teachers' reports of children's behavioral problems in school, as well as the quality of their relationships with their students. Parental questionnaires were available in either English or Spanish; 20 parents completed their questionnaires in Spanish. Two different translators used a forward and

backward translation method to translate questionnaires, and any discrepancies between the two translations were settled by a third translator.

Trained observers coded children's emotion expressivity and engagement in the classrooms, at recess, and at lunch (academic engagement was coded only in the classroom). Emotion observations in the fall and engagement observations in the spring were collected using a series of 30-second observation periods. Based on previous research, observations were collected three days a week for 9–12 weeks (usually 9–10 weeks; Fabes, Hanish, Martin, & Eisenberg, 2002). To ensure that identical protocol administration and coding criteria were maintained, reliability checks were made on a bi-weekly basis to ensure agreement with expert observers. Experimenters who administered the school assessment of EC were trained for five weeks and monitored by staff. Parents and teachers received a modest payment, and children received a small toy for participation.

2.2.1 SES—Parents provided an estimate of their combined family income (1= \$0-\$9,999 to 11= \$100,000 or over) as well as their education (1 = *less than HS diploma* to 4 = *college graduate or higher*). Correlations between income and parents' education were significant ($r_s = .56$ to $.59$, $p < .001$). A measure of SES was created by standardizing income, mother education, and father education and averaging all three of these scores together.

2.2.2 Observed Emotion Expressivity—Prior to data collection, observers ($n = 34$; 24 female and 10 male) were extensively trained (rating children's emotion expressivity and engagement in pre-coded videos and/or in pilot preschool settings) to code overt expressions of children's positive and negative emotions until acceptable reliability was reached with expert staff. Observers had a random-order list of participants for each class and were instructed to code children for 30-second observations (coding all children present prior to going through the list again). Coders were directed to remain as impassive and invisible as possible, to suppress all emotional reactions, and to avoid eye contact with children.

In the fall semester, broad measures of negative emotion (e.g., anger/frustration, sadness, fear) and positive emotion (e.g., happiness, joy, excitement, amusement) were coded based on the intensity, frequency, and duration of multiple behavioral domains. Intensity of the emotional episode was measured by considering the amount of change in seven domains of behavior: lower face (from lips to chin), middle face (cheeks and nose), upper face (eyes, eyebrows, and forehead), vocal tone (whiny, harsh, lilting), vocal content (emotion-focused language), posture (slumped, puffed out) and behavior (pointing sharply, crying, jumping for joy). Intensity was classified as either small (changes were present for only one domain of behavior), medium (changes only in two domains of behavior), or large (changes in three or more domains of behavior). Frequency was measured as the number of indicators observed and duration was measured as the length of time the child produced the indicator(s).

Criteria for negative emotion (indexed by expressivity) included, but were not limited to, the following: pouted lips and/or lips downturned in a frown (sadness), bottom lip pulled horizontally (fear/anxiety), pursed or pressed lips, jutted jaw (anger/frustration) for the lower face domain; brows down or arched (in sadness), raised (in fear/anxiety), or furrowed (in anger) for the upper face domain; crying or rubbing eyes (sadness), tapping or wringing

hands or biting nails (fear/anxiety), slamming hands/fist on something or roughly in the air, knocking things over, stomping (anger/frustration) for the behavior domain; burring the head in arm/hands, slumps shoulders (sadness), freezing or sudden jerks (fear/anxiety), arms stiff and in a low V, fists curled (anger/frustration) for the posture domain; statements such as “Math makes me nervous”, “S/he made me feel bad,” “This is making me mad,” “I’m getting pretty tired/sick of this” for the vocal content domain; whining (sadness), elevated tone (fear/anxiety), loud, harsh/cutting intonation (anger/frustration) for the vocal tone domain and slow and gentle sighs (sadness), screaming in anger, growling menacingly, grunting or roughly sighing (anger/frustration) for the vocalization domain.

The criteria for positive emotion (as indexed by expressivity) included, but was not limited to, smiling, grinning (even if only on one half of face) for the lower face domain; raised cheeks for the middle face domain; eyes squinted (in an intense smile) or wide and bright (when excited or joyful) for the upper face domain; jumping up and down, shaking hands excitedly for the behavior domain; chest and head up for the posture domain; statements such as “I’m happy,” “This is fun,” or “Yay” for the vocal content domain; upbeat tone (upward intonation but not whiny) or lilting (‘sing-song’) for the tone of voice domain and laughter, giggling, or excited squeals for the vocalization domain.

During each 30-second period, positive and negative emotion were coded as follows: 0 = no evidence of emotion; 1 = emotion seen once, small in intensity (changes only one domain of behavior) and brief (< 3 seconds); 2 = two indicators of emotion that were small in intensity and brief; one indicator of emotion that was small in intensity but lasting 4–9 seconds; or one indicator that was medium in intensity (changes only two domains of behavior) and lasting less than 5 seconds; 3 = three or more indicators that were small in intensity and brief; two or more indicators medium in intensity; one or more indicators, small in intensity and lasting more than 10 seconds; one or more emotional displays medium in intensity lasting more than 5 seconds or any high intensity (changes three or more domains of behavior) indicators.

Children were observed during class (mostly homeroom but also some specials like music and art), lunch, and recess in the fall. Two to three observers (depending on the number of children in a class to code) were assigned to each classroom, and each observed coded at a different time. Observers coded a total of 38,798 30-sec periods of positive emotion ($M = 128.90$ observation per child, range = 32 – 266) and a total of 37,265 30-sec periods of negative emotion ($M = 123.80$ observation per child, range = 32 – 266). One observer’s negative emotion observations were dropped due to unreliability. Reliability of observational coding was assessed from a set of pre-coded videos (which were only used for reliability purposes for the second cohort of children) and randomly selected live observations in which expert staff concurrently coded the same children as the observer for approximately fifty minutes every two weeks (both positive and negative emotion received a total of 3,814 reliability observations each; 3,064 in vitro and 750 via video). The interobserver reliabilities between the primary coders and the reliability coder were strong for both negative and positive emotion expressivity (ICCs = .96). The mean level of emotion was computed by averaging scores across all observations in the fall. Thirty children included in

analyses exhibited no negative emotion during observations, whereas all children exhibited some positive emotion.

2.2.3 Effortful Control—Parents, teachers and observers rated (1 = *extremely false* to 7 = *extremely true*) items tapping children's EC in the Fall using subscales from the Children's Behavioral Questionnaires (CBQ, Rothbart, Ahadi, Hershey, & Fisher, 2001). CBQ subscales included Attentional Focusing (13 items for parents, 11 for teachers and 5 for observers; e.g., "When working on an activity, has a hard time keeping her/his mind on it"; α s = .81, .93, and .95), Inhibitory Control (13 items for parents and teachers and 4 for observers; e.g., "Can wait before entering into new activities if s/he is asked to"; α s = .81, .92, and .93), and/or Attention Shifting (12 items for parents and teachers; e.g., "Can easily change from one activity to another"; α s = .83 and .94). Observers did not rate children's attention shifting. Some CBQ questions were slightly modified to increase comprehension and because some of the original items for teachers did not fit the school context as worded (e.g., "My child when watching TV, is easily distracted by other noises or movements" was changed to "This child, when watching a movie or presentation, is easily distracted by other noises or movements"). Correlations among the subscales ranged from r s(231) = .42 to .65 for parents, r s(300) = .75 to .85 for teachers, and r (286) = .90 for experiments, all p s < .001. The scales were averaged within reporter (α s for all items in the composite = .79, .92, and .95 for teachers, parents, and experimenter).

In addition, trained experimenters ($n = 15$; all women) administered a computer-based continuous performance task (CPT) to assess EC (adapted from NICHD, 2003). Children were seated in front of computer and asked to press the space bar as soon as the target stimulus (a fish) appeared on the screen. Two hundred and twenty pictures of different familiar objects (e.g., butterfly, flower) were randomly presented on the screen, including 44 presentations of the target stimulus and 176 presentations of non-target stimuli. Stimuli appeared on the screen for 0.5 seconds with 1.5 seconds intervals between stimuli. Children were asked to press the space bar immediately upon seeing the target stimulus in order to get the trial correct. All but one child (who moved away) completed the task ($M = 219$ trials per child, range = 136 – 220). The proportion of false alarms (e.g., saw no target stimulus and pressed) was subtracted from the proportion of correct hits (e.g., pressed in response to target stimulus). High scores reflect higher EC.

2.2.4 Academic Engagement—During the spring, observers ($n = 35$; 25 female and 10 male) were trained to code academic engagement for 30-second observation periods during approximately 9–12 weeks of data collection. Engagement was operationalized as attending to the task materials/teacher in an appropriate manner (e.g., not throwing the materials around or absent-mindedly holding them). For example, if the task was to listen, an engaged child was expected to not be actively distracted by something else, fidgeting or playing with something (e.g., shoelaces), or looking at something other than the speaker (e.g., posters on the wall). If the task was to actively participate, full engagement points were not awarded for just paying attention. The child must have also been participating appropriately (e.g., repeating words, dancing/singing, etc.). Engagement did not imply compliance. Children were considered engaged if they did not do the assigned task as directed, but they were still

trying (e.g., coloring a snowman purple instead of blue like the teacher asked). Engagement was coded based on the task that the child was supposed to be doing, not what the rest of the class was doing (often, but not always, these were the same). During each 30-second period in the classroom when an academic task was provided by a teacher or the teacher was talking, but not during transitions between activities (e.g., lining up to go outside; moving from carpet to desks; clean up time), engagement was coded as follows: 0 = attends to the task/material for less than 5 seconds; 1 = minimally (briefly or sporadically) engaged, attends to the teacher between 6 and 15 seconds; 2 = moderately (somewhat) engaged, attends to the teacher between 16 and 25 seconds; or 3 = highly engaged, attends 26+ seconds; may look away for short periods (<5 second chunks of time; e.g., social referencing).

Because engagement was coded only during instructional time when students were participating in curriculum or educationally related activities under the direction of a teacher, not during lunch or recess, the number of engagement scans was lower than the number of observed emotions: coders observed a total 22,022 30-sec periods of engagement ($M = 74.90$ observations per child, range = 32– 197). One observer's observations of engagement were dropped due to unreliability (ICC = .96). Reliability between the primary coders and the reliability coder was assessed as outlined before (engagement received a total of 2,868 reliability observations; 2,633 in vitro and 235 via video). Academic engagement was computed by averaging scores across all observations for each child in the spring. All children exhibited some engagement.

2.2.5 Reported Student-Teacher Relationship—In the spring, teachers rated (1 = *definitely does not apply* to 5 = *definitely applies*) 15 items from the Student–Teacher Relationship Scale (Pianta, 2001) regarding their closeness (8 items; e.g., “I share an affectionate warm relationship with this child”; $\alpha = .81$) and conflict (7 items; e.g., “This child and I always seem to be struggling with each other”; $\alpha = .90$) with each participating student.

2.2.6 Reported Externalizing Problem Behaviors—Also in the spring, teachers rated (0 = *never*, 1 = *sometimes*, 2 = *often*) children's problem behaviors on the MacArthur Health and Behavior Questionnaire (HBQ) (Armstrong & Goldstein, 2003). Teachers reported on the frequency of oppositional defiance (9 items: e.g. “Is defiant, talks back to adults”; $\alpha = .89$), conduct problems (11 items: e.g. “Destroys things belonging to other children”; $\alpha = .84$), and relational aggression (6 items: e.g. “Verbally threatens to keep a peer out of the play group if the peer doesn't do what he/she wants”; $\alpha = .94$). Correlations among the subscales ranged from $r_s(287) = .63$ to $.78$, $p_s < .001$. The scales were averaged to create an externalizing behavior composite ($\alpha = .73$).

3. Results

Prior to testing the main hypotheses, and to simplify the analyses, we created a factor score for children's EC based on a confirmatory factor analysis (CFA). Then we used path analyses to test main effects and interactions between emotion expressivity and EC. Because children in the present study were nested within classrooms, there were intra-class correlations (ICCs) for the main study variables (e.g., emotion, EC, teacher-relationship

quality etc.) that ranged from 0 –.26 due to children’s ratings being similar by virtue of sharing the same classroom. Consequently, Type=complex was used to adjust standard errors in order to account for the nested structure of the data in Mplus 6 (Muthén & Muthén, 1998–2014). To account for missing data, full information maximum likelihood estimation with robust standard errors (MLR) was used. The pattern of findings was very similar when controlling for cohort so the cohorts were combined. Table 1 contains descriptive statistics.

3.1 Preliminary Analyses

A CFA was specified for EC using teacher-, parent-, and observer-reported EC and school assessment of EC as indices of children’s EC (four indicators). Zero-order correlations among the four indices ranged from $r(299) = .25$ to $.30$, $ps < .001$. The CFA model fit was considered acceptable if the comparative fit index (CFI) was close to or above .95 and the root mean square error of approximation (RMSEA) was less than .08 (Hu & Bentler, 1999). The CFA fit the data well, $\chi^2(2) = 1.00$, $p = .61$; CFI = 1.00; RMSEA < .01; SRMR < .02. The standardized loadings ranged from .39 – .80 and were all significant and in the expected direction. Using the SAVE IS FSCORES command in Mplus, a factor score was calculated and then used in subsequent analyses in Mplus to examine main and moderation effects.

3.2 Relations of Key Variables with Age, Sex, and Race/ethnicity

To examine age, sex, and ethnicity differences while considering clustering within classrooms, a series of separate analyses in Mplus were performed for emotion, EC, academic engagement, student-teacher relationship, and externalizing behaviors at school. Girls were significantly higher on EC and observed negative emotion expressivity ($M_s = .15$ and $.09$, $SD_s = .87$ and $.09$) than were boys ($M_s = -.16$ and $.07$, $SD_s = .85$ and $.07$), $t(300) = -3.19$ and -2.08 , $ps < .04$. Age was not related to any of the key variables.

3.3 Correlations Among the Key Constructs

The correlations shown in Table 2 were estimated in Mplus to account for clustering within classroom. Negative expressivity was negatively correlated with EC ($r = .25$) and academic engagement ($r = -.37$) and positively with student-teacher conflict ($r = .31$) and behavioral problems ($r = .29$). EC was positively correlated with academic engagement ($r = .47$) and student-teacher closeness ($r = .22$) as well as negatively correlated with student-teacher conflict ($r = -.61$) and behavioral problems ($r = -.51$). Academic engagement was negatively correlated with student-teacher conflict ($r = -.41$) and behavioral problems in school ($r = -.38$). Student-teacher conflict was positively correlated with behavioral problems ($r = .76$). Positive expressivity was not significantly correlated with any outcomes.

3.4 Main Effects Analyses

We used Mplus to examine if observational measures of emotion expressivity and EC predicted later school outcomes. In the same path analysis, four dependent variables (student-teacher conflict and closeness, academic engagement, and behavioral problems at school) were regressed on two predictors (expressed negative emotion and EC) and five covariates (age, sex, ethnicity, SES, and percent of classroom observations). The predictors

were also regressed on to the covariates. Similar analyses were then performed with positive emotion expressivity and EC as the predictors.

The first path analysis, which involved prediction from observed negative emotion and EC, fit the data well $\chi^2(4) = 2.86, p = .58$; CFI = 1.00; RMSEA < .001; SRMR < .02. Negative emotion expressivity positively predicted student-teacher conflict, $b = .17, p < .001$, and behavioral problems, $b = .16, p < .001$, and negatively predicted academic engagement, $b = -.25, p < .001$. Children's EC negatively predicted student-teacher conflict and behavioral problems, $bs = -.59$ and $-.50, ps < .001$, and positively predicted engagement and student-teacher closeness, $bs = .43$ and $.22, ps = .011$ and $.003$. Although the second model examining positive emotion expressivity and EC had an adequate fit, $\chi^2(4) = 5.52, p = .32$; CFI = 1.00; RMSEA < .02; SRMR = .03, positive emotion did not predict school outcomes whereas the pattern of findings for EC mirrored those in the first model.

3.5 Tests of Moderation

Next, we examined the moderating role of EC on the relation between emotion expressivity (positive or negative) and school outcomes. In order to test our hypotheses, continuous variables were centered and an interaction term was created by multiplying centered emotion (positive and negative emotion separately) with EC. Four dependent variables (student-teacher conflict and closeness, academic engagement, and behavioral problems) were regressed on to three predictors (emotion, EC, and their interaction) and on to five covariates (age, sex, ethnicity, SES, and percent of classroom observations). Predictors were also regressed on to the covariates. The first model examined whether negative emotion expressivity interacted with EC to predict outcomes. This path model fit the data well, $\chi^2(4) = 2.86, p = .58$; CFI = 1.00; RMSEA < .001; SRMR < .05; see Figure 1A. Children's EC negatively predicted student-teacher conflict and behavioral problems, $bs = -.59$ and $-.49, ps < .001$, and positively predicted teacher closeness and academic engagement, $b = .23$ and $.42, ps < .01$. Negative emotion positively predicted student-teacher conflict and behavioral problems, $bs = .14$ and $.12, ps < .03$, and negatively predicted academic engagement, $b = -.21, p < .02$. There was a significant interaction between negative emotion and EC predicting student-teacher conflict, academic engagement, and problem behaviors at school, $bs = -.20, -.23,$ and $-.25, ps < .01$. An analogous model with positive emotion expressivity fit the data well, $\chi^2(4) = 4.68, p = .32$; CFI = 1.00; RMSEA < .05; SRMR < .05; see Figure 1B. EC mirrored the results of the first model. Positive emotion negatively predicted academic engagement, $b = -.21, p < .05$. Additionally, the interaction between positive emotion and EC predicted academic engagement, $b = -.13, p < .03$.

Using procedures outlined by Aiken and West (1991), when an interaction was significant, simple slopes were examined at low (-1 SD below the mean), moderate (mean), and high ($+1$ SD above the mean) levels of EC. As predicted, the positive relation between observed negative emotion and student-teacher conflict was significant at low and moderate levels of EC, $bs = 4.04$, and $1.51, zs = 3.53$ and $3.23, ps < .05$, but not high levels of EC (Figure 2, Graph A). Those high in EC tended to be low in conflict regardless of the level of negative expressivity. The negative relation between negative expressivity and academic engagement was significant at low and moderate levels of EC, $bs = -1.26$ and $-.56, z(292) = -4.49$ and

–3.19, $ps < .01$, but not for high levels of EC (where engagement was consistently high; Figure 2, Graph B). Negative expressivity was also significantly positively related to behavioral problems at a low EC, $b = 1.47$, $z(292) = 3.34$, $p = .001$ but not moderate or high levels of EC (Figure 2, Graph C). Children higher in EC tended to be lower in externalizing behavior regardless of their level of observed negative emotion. Lastly, there was a negative relation between positive expressivity and academic engagement at low and moderate levels of EC, $bs = -.19$ and $-.09$, $zs(292) = -2.29$ and -2.00 , $ps < .05$, but not at high EC (where engagement was consistently high; Figure 2, Graph D).

4. Discussion

A growing body of research supports the critical role of children's emotions expressed at school and EC in their development, including adapting to the school context. However, the pattern of findings is limited in early childhood and, at times, contradictory (Lewis et al., 2009; Raver et al., 2007; Reschly et al., 2008). Furthermore, only a few researchers have examined the interaction of positive and negative emotionality and regulation when predicting school-related outcomes and those findings have also been somewhat inconsistent (Belsky et al., 2001; Rydell et al., 2003; Valiente et al., 2010; Valiente et al., 2012). Using multiple methods and reporters, we examined main and interactive effects of children's EC and naturally occurring observed emotionality at school to emerging interpersonal relationships with teachers, observed academic engagement, and behavioral problems in school. Children's expressed negative emotions and EC were associated with the quality of teacher relationships, as well as children's engagement and behavioral problems. In addition, EC moderated the relation between observed emotion expressivity and school outcomes. Because we assessed these relations at the beginning of formal schooling, individual differences in emotion expressivity and EC, in part stemming from temperament, may have important implications for the initial adaptation to school.

As hypothesized, observed negative emotion expressivity was most strongly negatively related to academic engagement at low and moderate levels of EC and was unrelated to engagement at high EC. Similarly, negative emotion was positively related to student-teacher conflict at low and moderate levels of EC and behavioral problems at low levels of EC. Children low in EC, compared to children with greater EC, may be particularly vulnerable to the poor outcomes associated with negative emotion as they struggle to manage their emotions and behaviors in the classroom. EC may buffer children from some of the negative consequences associated with negative emotion. That is, the ability to pay attention, focus, and inhibit impulsive behaviors in the classroom may be very beneficial for children who are high in negative emotion expressivity and inclined to problematic behaviors that undermine relationships and participation at school.

This study moved beyond the frequent use of solely reports of children's negative emotion or, occasionally, negative emotions assessed briefly in the laboratory, and utilized extensive observations of emotions and engagement in the school context. Unlike most relevant previous research, EC was also assessed using multiple adult reporters and a behavioral task. Nonetheless, our findings are similar to those found in a number of studies of children's general social competence and problem behaviors (e.g., Eisenberg et al., 2000), not

necessarily confined to, or in, the school context. Valiente and colleagues (2012) obtained results similar to this study but with the use of adults' reports of anger and EC. Additionally, researchers have reported interactions between reported regulation and negative emotionality when predicting problem behaviors (assessed across multiple contexts), with the negative relations usually being strongest for children high in negative emotionality (Eisenberg, Fabes, et al., 1996; Eisenberg et al., 2000). Although the moderator in these studies often was negative emotionality rather than EC, the pattern of results is similar to that found in this study (see graphs). However, results might also vary somewhat as a function of the type of negative emotion assessed (as well as other factors discussed earlier). Our observations of broad negative emotion reactivity may have tapped into feelings such as fear or anxiety and not solely sadness and anger.

EC also interacted with positive emotion expressivity when predicting academic engagement at school. The negative relation between positive emotion and engagement was strongest at low levels EC. Rydell et al. (2003) also found that 5- to 8-year-olds who were high in positivity and low in regulation exhibited poorer adaptive behaviors than children with better self-regulation skills. Behaviors such as jumping up and down with excitement may make it difficult to focus on lessons and properly engage in classroom activities if not properly regulated. Few researchers have examined interactions of positive emotion expressivity with EC when predicting important developmental outcomes, especially in the school context (Perkun et al., 2002). These results are also relatively unique because positive emotion expressivity at school was observed; in most studies, children's dispositional positive emotion has been reported—a measure that often may tap positive emotionality in multiple contexts, not only at school. However, it is important to note that results may differ depending on the operationalization of positive emotion. Future studies could investigate different operationalizations of positive emotion with and without aspects of activity in order to better understand relations between positive emotion and EC on school outcomes.

An important component of this study was the inclusion of temperamental emotional reactivity, both negative and positive, when examining school outcomes. Children in our sample generally did not exhibit high negative emotionality. Nevertheless, teachers may be more responsive to negative expressivity (e.g., yelling, crying, arguing,) than positive expressivity in the classroom and perceive negative emotions more inappropriately. Negative emotions tend to undermine the quality of student–teacher interaction, motivation to complete school work, and are linked to higher levels of aggressive behaviors towards others (Eisenberg et al., 2000; Pekrun, 2006; Reschly et al., 2008). Indeed, main effects analyses suggest that observed negative emotion at school was related to impaired school adjustment. However, positive emotion was not related to teacher-student relationship quality or behavioral problems at school, perhaps because negative emotions are more noticeable and draining for teachers than positive emotion.

EC was positively related to better teacher relationships as well as academic engagement. It was also negatively associated with behavioral problems in school. Relatively few researchers have focused on relations of EC to aspects of academic engagement (cf., Valiente et al., 2007; Valiente et al., 2008) and none, to our knowledge, have utilized observed engagement in the classroom. The findings are strengthened by the use of multiple

reporters and methods, supporting the notion that greater EC is likely associated with the development of academic engagement, and the quality of teacher-student relationships (Valiente et al, 2012). In addition, EC probably contributes to children's ability to behave appropriately at school (Eisenberg et al., 2000; Belsky et al., 2001).

4.1 Strengths and Limitations

Despite the strengths of this study, it is not without limitations. All of the measures were obtained during a single year. Although this study implemented a short-term longitudinal design (i.e., emotion observations and EC were measured in the fall and school-related outcomes in the spring), it is important to look at these associations over a longer periods to detect developmental changes in the characteristics of the target population at the individual level. Moreover, the data are correlational so causal relations cannot be proved. This study also relied on teachers' reports of externalizing behavior. Teachers are only aware of children behaviors in the school context, which may under- or overestimate children's level of externalizing behaviors. In future studies, investigators might include multiple reporters and methods to assess children's problem behaviors in school. Subsequent studies with larger sample sizes could also examine both positive and negative expressivity in a single model and, thus, assess unique predictive effects of emotional expressivity as well as more complex interactions. In addition, because only broad measures of negative and positive emotion expressivity were coded, we could not differentiate between the types of emotion; for instance, anger, fear, or sadness. Research that involves a more fine-grained approach might produce more nuanced findings. Indeed, approach vs. withdrawal-related affect may have different interactive associations with EC compared to a general level of emotion (Harmon-Jones, Schmeichel, Mennitt, & Harmon-Jones, 2011).

Despite these limitations, this study provides some of the first evidence linking kindergarteners' positive and negative emotion observed in the school context for an extended period of time to school outcomes. We assessed naturally occurring emotions at school using over 35,000 observations, and over 20,000 observations of engagement in the classroom. There are no studies, to our knowledge, that have used such rich observations of emotion in the school context during a critical transition period to predict academic engagement, quality of teacher – student relationships or behavioral problems in school. Moreover, our findings in regard to the interaction of emotionality with EC suggest that interventions to promote EC might result in reducing the academic risk associated with the expression of high levels of emotion. A fuller understanding of these relations is needed given the associations of early school engagement, teacher relationships, and conduct problems to later successful academic trajectories (Hinshaw, 1992; Valiente et al., 2012; Ladd, Birch et al., 1999).

5. Conclusion

In sum, we found evidence that both children's emotions and EC were related to academic engagement and relationships with teachers as well as behavioral problems at school. Moreover, EC moderated the relations of emotion to school outcomes, such that children with low EC may be at greatest risk for the detrimental effect of negative emotion

expressivity on school outcomes than children high in EC. Additionally, children high in positivity and low in EC may be more likely to exhibit poorer adaptive behaviors in the classroom. These findings have implications regarding the role of temperament, especially EC, in cultivating positive relationships in school, increasing children's engagement, and lowering behavioral problems, which in turn might foster academic success (Valiente et al, 2008). Furthermore, school-based interventions could try to improve children's EC. There is experimental evidence that suggest incorporating curriculums in school that promote self-regulation skills can successfully develop EC and increase academic achievement in early childhood (Barnett et al, 2008).

Acknowledgments

Research reported in this publication was supported by the Eunice Kennedy Shriver National Institute of Child Health and Human Development of the National Institutes of Health (NIH) (R01HD068522) to Carlos Valiente and Nancy Eisenberg. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH.

References

- Aiken, LS., West, SG. Multiple regression: Testing and interpreting interactions. Newbury Park: Sage; 1991.
- Armstrong JM, Goldstein LH. The MacArthur Working Group on outcome assessment. Manual for the MacArthur Health and Behavior Questionnaire (HBQ 1.0). 2003
- Barnett SW, Jung K, Yarosz DJ, Thomas J, Hornbeck A, Stechuk R, Burns S. Educational effects of the Tools of the Mind curriculum: A randomized trial. *Early Childhood Research Quarterly*. 2008; 23:299–313.
- Belsky J, Friedman SL, Hsieh K. Testing a core emotion-regulation prediction: Does early attentional persistence moderate the effect of infant negative emotionality on later development? *Child Development*. 2001; 72:123–133. [PubMed: 11280474]
- Bingham, GE., Okagaki, L. Ethnicity and student engagement. In: Christenson, SL, Reschley, AL., Wylie, C., editors. *Handbook of Research on Student Engagement*. New York, NY: Springer; 2012. p. 65-95.
- Bub KL, McCartney K, Willett JB. Behavior problem trajectories and first-grade cognitive ability and achievement skills: A latent growth curve analysis. *Journal of Educational Psychology*. 2007; 99:653–670.
- Bulotsky-Shearer RJ, Fantuzzo JW. Preschool behavior problems in classroom learning situations and literacy outcomes in kindergarten and first grade. *Early Childhood Research Quarterly*. 2011; 26:61–73.
- Campbell SB, Spieker S, Burchinal MR, Poe MD. The NICHD ECCRN. Trajectories of aggression from toddlerhood to age 9 predict academic and social functioning through age 12. *Journal of Child Psychology and Psychiatry*. 2006; 47:791–800. [PubMed: 16898993]
- Conway AM, McDonough SC. Emotional Resilience in Early Childhood. *Annals of the New York Academy of Sciences*. 2006; 1094:272–277. [PubMed: 17347360]
- Davis H, Carr M. Gender differences in mathematics strategy use: The influence of temperament. *Learning and Individual Differences*. 2002; 13:83–95.
- De Pauw Sarah SW, Mervielde I, Van Leeuwen KG. How are traits related to problem behavior in preschoolers? Similarities and contrasts between temperament and personality. *Journal of Abnormal Child Psychology*. 2009; 37:309–325. [PubMed: 19165590]
- Denham, S. *Emotional development in young children*. New York, NY: Guilford; 1998.
- Diener ML, Kim D. Maternal and child predictors of preschool children's social competence. *Journal of Applied Developmental Psychology*. 2004; 25:3–24.

- Eisenberg N, Fabes RA, Bernzweig J, Karbon M, Poulin R, Hanish L. The relations of emotionality and regulation to preschoolers' social skills and sociometric status. *Child Development*. 1993; 64:1418–1438. [PubMed: 8222881]
- Eisenberg N, Fabes RA, Nyman M, Bernzweig J, Pinuelas A. The relations of emotionality and regulation to children's anger-related reactions. *Child Development*. 1994; 65:109–128. [PubMed: 8131642]
- Eisenberg N, Fabes R, Guthrie I, Murphy B, Maszk P, Holmgren R, Suh K. The relations of regulation and emotionality to problem behavior in elementary school. *Development and Psychopathology*. 1996; 8:141–162.
- Eisenberg N, Guthrie IK, Fabes RA, Shepard S, Losoya S, Murphy BC, Reiser M. Prediction of elementary school children's externalizing problem behaviors from attention and behavioral regulation and negative emotionality. *Child Development*. 2000; 71:1367–1382. [PubMed: 11108101]
- Eisenberg, N., Martin, CL., Fabes, RA. Gender development and gender effects. In: Berliner, DC., Calfee, RC., editors. *Handbook of educational psychology*. New York, NY: MacMillan; 1996. p. 358-396.
- Eisenberg N, Spinrad TL, Eggum ND. Emotion-related self-regulation and its relation to children's maladjustment. *Annual Review of Clinical Psychology*. 2010; 6:495–525.
- Fabes RA, Hanish LD, Martin CL, Eisenberg N. Young children's negative emotionality and social isolation: A latent growth curve analysis. *Merrill-Palmer Quarterly*. 2002; 48:284–307.
- Fredrickson BL. The role of positive emotions in positive psychology: The broaden-and-build theory of positive emotions. *American Psychologist*. 2001; 56:218–226. [PubMed: 11315248]
- Fredricks, J., McColskey, W. The measurement of student engagement: A comparative analysis of various methods and student self-report instruments. In: Christenson, SL, Reschly, AL., Wylie, C., editors. *Handbook of Research on Student Engagement*. New York, NY: Springer; 2012. p. 763-782.
- Graziano PA, Reavis RD, Keane SP, Calkins SD. The role of emotion regulation in children's early academic success. *Journal of School Psychology*. 2007; 45:3–19. [PubMed: 21179384]
- Hamre BK, Pianta RC. Early teacher-child relationships and the trajectory of children's school outcomes through eighth grade. *Child Development*. 2001; 72:625–638. [PubMed: 11333089]
- Harmon-Jones C, Schmeichel BJ, Mennitt E, Harmon-Jones E. The expression of determination: Similarities between anger and approach-related positive affect. *Journal of Personality and Social Psychology*. 2011; 100:172–181.
- Hinshaw SP. Externalizing behavior problems and academic underachievement in childhood and adolescence: Causal relationships and underlying mechanisms. *Psychological Bulletin*. 1992; 111:127–155. [PubMed: 1539086]
- Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*. 1999; 6:1–55.
- Kagan, J. Galen's prophecy. *Temperament in human nature*. New York, NY: Basic Books; 1994.
- Kagan J, Snidman N, McManis M, Woodward S, Hardway C. One measure, one meaning: Multiple measures, clearer meaning. *Development and Psychopathology*. 2002; 14:463–475. [PubMed: 12349869]
- Keogh, BK. *Temperament in the classroom*. Baltimore, MD: Paul H. Brookes; 2003.
- Kim G, Walden T, Harris V, Karrass J, Catron T. Positive emotion, negative emotion, and emotion control in the externalizing problems of school-aged children. *Child Psychiatry and Human Development*. 2006; 37:221–239.
- Kim S, Nordling JK, Yoon JE, Boldt LJ, Kochanska G. Effortful control in “Hot” and “Cool” tasks differentially predicts children's behavior problems and academic performance. *Journal of Abnormal Child Psychology*. 2012; 41:43–56.
- Kochanska G, Murray KT, Harlan ET. Effortful control in early childhood: Continuity and change, antecedents, and implications for social development. *Developmental Psychology*. 2000; 36:220–232. [PubMed: 10749079]
- Ladd GW, Birch SH, Buhs ES. Children's social and scholastic lives in kindergarten: Related spheres of influence? *Child Development*. 1999; 70:1373–1400. [PubMed: 10621962]

- Ladd GW, Burgess KB. Charting the relationship trajectories of aggressive, withdrawn, and aggressive/withdrawn children during early grade school. *Child Development*. 1999; 70:910–929. [PubMed: 10446726]
- Ladd G, Dinella LM. Continuity and change in early school engagement: Predictive of children's achievement trajectories from first to eighth grade? *Journal of Educational Psychology*. 2009; 101:190–206. [PubMed: 23060683]
- Lewis AD, Huebner ES, Reschly AL, Valois RF. The incremental validity of positive emotions in predicting school functioning. *Journal of Psychoeducational Assessment*. 2009; 27:397–408.
- Liew J, Chen Q, Hughes JN. Child effortful control, teacher-student relationships, and achievement in academically at-risk children: Additive and interactive effects. *Early Childhood Research Quarterly*. 2010; 25:51–64. [PubMed: 20161421]
- Linnenbrink, EA. The role of affect in student learning: A multi-dimensional approach to considering the interaction of affect, motivation, and engagement. In: Schutz, PA., Pekrun, R., editors. *Emotion in education*. Boston, MA: Academic Press; 2007. p. 107-124.
- Majdandžić M, Van Den Boom DC. Multimethod Longitudinal Assessment of Temperament in Early Childhood. *Journal of Personality*. 2007; 75:121–168. [PubMed: 17214594]
- Mervielde I, De Clercq B, De Fruyt F, Van Leeuwen K. Temperament, personality, and developmental psychopathology as childhood antecedents of personality disorders. *Journal of Personality Disorders*. 2005; 19:171–201. [PubMed: 15899715]
- Masten AS, Roisman GK, Long JD, Burt KB, Obradovic J, Riley JR, Tellegen A. Developmental cascades: Linking academic achievement and externalizing and internalizing symptoms over 20 years. *Developmental Psychology*. 2005; 41:733–746. [PubMed: 16173871]
- Metsäpelto R, Pakarinen E, Kiuru N, Poikkeus A, Lerkkanen M, Nurmi J. Developmental dynamics between children's externalizing problems, task-avoidant behavior, and academic performance in early school years: A 4-year follow-up. *Journal Of Educational Psychology*. 2015; 107(1):246–257.
- Muthén LK, Muthén BO. *Mplus User's Guide*. 1998–2014
- NICHHD. Do children's attention processes mediate the link between family predictors and school readiness? *Developmental Psychology*. 2003; 39:581–593. [PubMed: 12760525]
- Olson SL, Sameroff AJ, Kerr DCR, Lopez NL, Wellman HM. Developmental foundations of externalizing problems in young children: The role of effortful control. *Development and Psychopathology*. 2005; 17:25–45. [PubMed: 15971758]
- Orth LC, Martin RP. Interactive effects of student temperament and instruction method on classroom behavior and achievement. *Journal of School Psychology*. 1994; 32:149–166.
- Pianta, R. *Student-teacher relationship scale-Short form*. Lutz, FL: Psychological Assessment Resources, Inc.; 2001.
- Pianta, RC., Cox, MJ., Snow, KL. *School readiness and the transition to kindergarten in the age of accountability*. Baltimore, MD: Paul H. Brookes; 2007.
- Pekrun R. The control-value theory of achievement emotions: Assumptions, corollaries, and implications for educational research and practice. *Educational Psychology Review*. 2006; 18:315–341.
- Pekrun R, Goetz T, Titz W, Perry RP. Academic emotions in students' self-regulated learning and achievement: A program of qualitative and quantitative research. *Educational Psychologist*. 2002; 37:91–105.
- Pekrun, R., Linnenbrink-Garcia, L. *Academic emotions and student engagement*. New York, NY: Springer Science + Business Media; 2012.
- Putnam S, Rothbart M, Gartstein M. Homotypic and heterotypic continuity of finegrained temperament during infancy, toddlerhood, and early childhood. *Infant and Child Development*. 2008; 17:387–405.
- Raver CC. Emotions matter: Making the case for the role of young children's emotional development for early school readiness. *Social Policy Report*. 2002; 16:3–18.
- Raver, CC., Garner, P., Smith-Donald, R. The roles of emotion regulation and emotion knowledge for children's academic readiness: Are the links causal?. In: Pianta, B.Snow, K., Cox, M., editors.

- Kindergarten transition and early school success. Baltimore, MD: Brookes Publishing; 2007. p. 121-148.
- Reschly AL, Huebner ES, Appleton JJ, Antaramian S. Engagement as flourishing: The contribution of positive emotions and coping to adolescents' engagement at school and with learning. *Psychology in the Schools*. 2008; 45:419–431.
- Rimm-Kaufman S, Pianta RC. An ecological perspective on the transition to kindergarten: A theoretical framework to guide empirical research. *Journal of Applied Developmental Psychology*. 2000; 21:491–511.
- Rothbart MK, Ahadi SA, Hershey KL. Temperament and social behavior in childhood. *Merrill-Palmer Quarterly*. 1994; 40:21–39.
- Rothbart MK, Ahadi SA, Hershey KL, Fisher P. Investigations of temperament at to seven years: The Children's Behavior Questionnaire. *Child Development*. 2001; 72:1394–1408. [PubMed: 11699677]
- Rothbart, MK., Bates, JE. Temperament. In: Damon, W., Lerner, R., Eisenberg, N., editors. *Handbook of child psychology: Vol. 3, social, emotional and personality development*. 6th. New York, NY: Wiley; 2006. p. 99-166.(Series Ed.) (Vol. Ed.)
- Rothbart, MK., Bates, JE. Temperament. In: Damon, W., Eisenberg, N., editors. *Handbook of child psychology: Vol. 3. Social, emotional and personality development*. 5th. New York: Wiley; 1998. p. 140-176.(Series Ed.) (Vol. Ed.)
- Rothbart, MK., Chew, KH., Gartstein, MA. Assessment of temperament in early development. In: Singer, LT., Zeskind, PS., editors. *Biobehavioral assessment of the infant*. New York: Guilford Press; 2001. p. 190-208.
- Rudasill KM, Rimm-Kaufman S. Teacher-child relationship quality: The roles of child temperament and teacher-child interactions. *Early Childhood Research Quarterly*. 2009; 24:107–120.
- Rydell A, Berlin L, Bohlin G. Emotionality, emotion regulation, and adaptation among 5- to 8-year-old children. *Emotion*. 2003; 3:30–47. [PubMed: 12899315]
- Seifer R, Sameroff A, Dickstein S, Schiller M, Hayden LC. Your own children are special: Clues to the sources of reporting bias in temperament assessments. *Infant Behavior and Development*. 2004; 27:323–341.
- Sette S, Baumgartner E, Schneider BH. Shyness, child-teacher relationships, and socio-emotional adjustment in a sample of Italian preschool-aged children. *Infant and Child Development*. 2014; 23:323–332.
- Shonkoff, JP., Phillips, DA., editors. *From neurons to neighborhoods: The science of early childhood development*. Washington, DC: National Academy Press; 2000.
- Silva KM, Spinrad TL, Eisenberg N, Sulik MJ, Valiente C, Huerta S, Taylor HB. Relations of children's effortful control and teacher-child relationship quality to school attitudes in a low-income sample. *Early Education and Development*. 2011; 22:434–460. [PubMed: 22573932]
- Spinrad TL, Eisenberg N, Silva KM, Eggum ND, Reiser M, Edwards A, Gaertner BM. Longitudinal relations among maternal behaviors, effortful control and young children's committed compliance. *Developmental Psychology*. 2012; 48:552–566. [PubMed: 22004341]
- Stifter CA, Willoughby MT, Towe-Goodman N. Agree or agree to disagree? Assessing the convergence between parents and observers on infant temperament. *Infant and Child Development*. 2008; 17:407–426. [PubMed: 19936035]
- Tackett JL, Kushner SC, De Fruyt F, Mervielde I. Delineating personality traits in childhood and adolescence: Associations across measures, temperament, and behavioral problems. *Assessment*. 2013; 20:738–751. [PubMed: 24270361]
- Valiente C, Lemery-Chalfant K, Castro KS. Children's effortful control and academic competence. Mediation through school liking. *Merrill-Palmer Quarterly*. 2007; 53:1–25.
- Valiente C, Lemery-Chalfant K, Swanson J. Prediction of kindergartners' academic achievement from their effortful control and emotionality: Evidence for direct and moderated relations. *Journal of Educational Psychology*. 2010; 102:550–560.
- Valiente C, Lemery-Chalfant K, Swanson J, Reiser M. Prediction of children's academic competence from their effortful control, relationships, and classroom participation. *Journal of Educational Psychology*. 2008; 100:67–77. [PubMed: 21212831]

- Valiente C, Swanson J, Lemery-Chalfant K. Kindergartners' temperament, classroom engagement, and student-teacher relationship: Moderation by effortful control. *Social Development*. 2012; 21:558–576.
- Valiente C, Eisenberg N, Smith CL, Reiser M, Fabes RA, Losoya S, Murphy BC. The relations of effortful control and reactive control to children's externalizing problems: A longitudinal assessment. *Journal of Personality*. 2003; 71:1171–1196. [PubMed: 14633062]

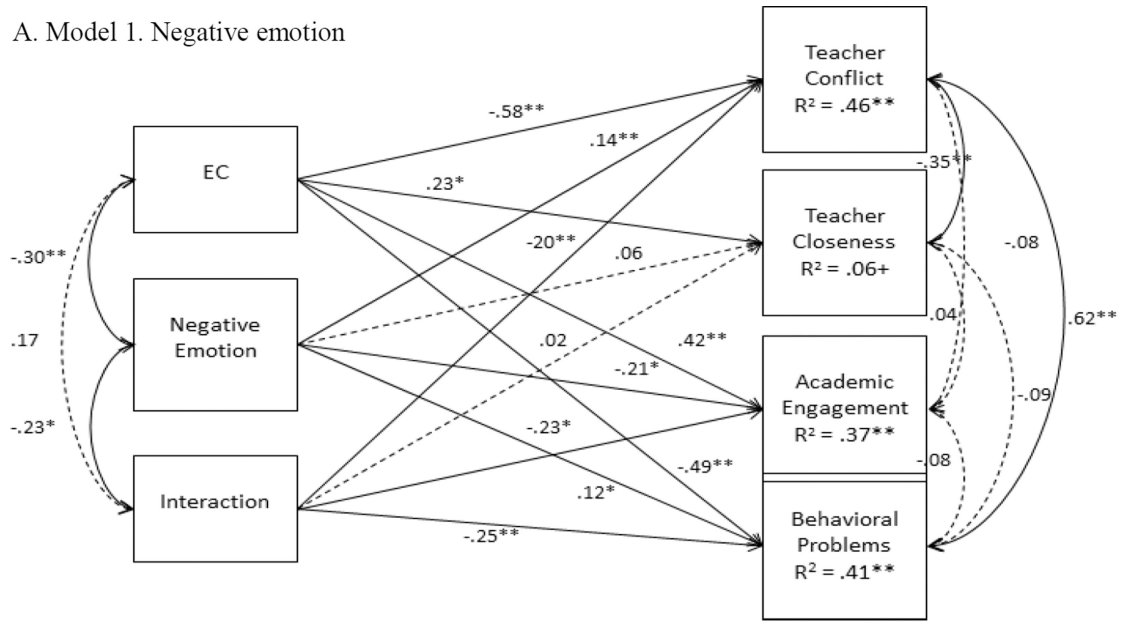
Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

A. Model 1. Negative emotion



B. Model 2. Positive emotion

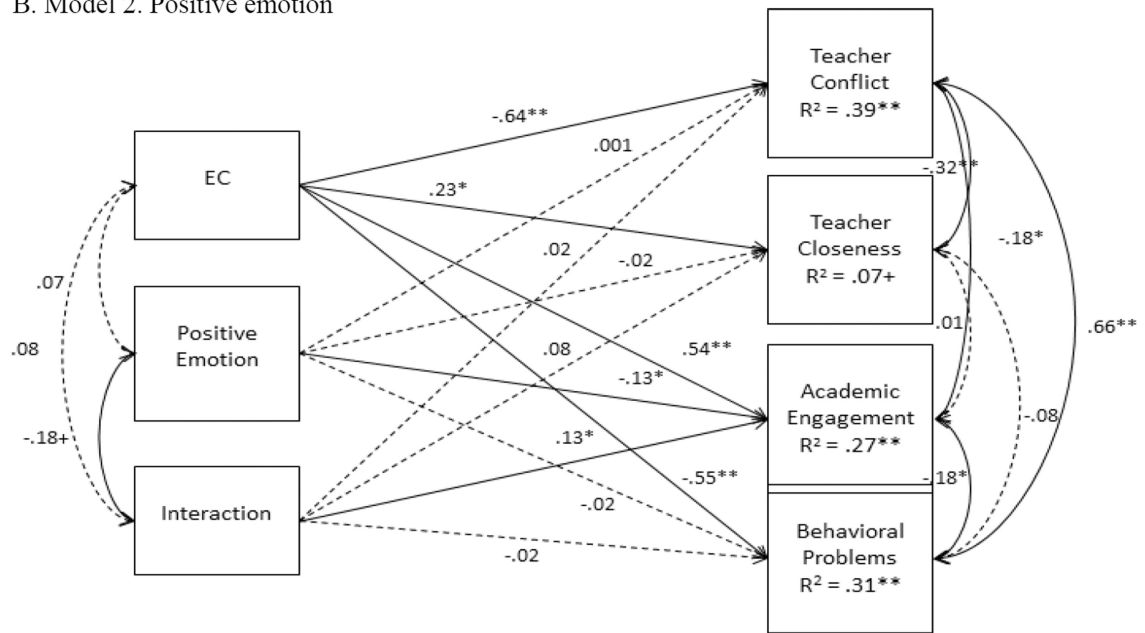


Figure 1. Path analyses assessing school outcomes from observed emotion and EC and their interaction. Covariates: Age, sex, SES, ethnicity and percent of classroom observations. Coefficients are standardized. Nonsignificant paths are dashed. +p < .10, *p < .05, **p < .01.

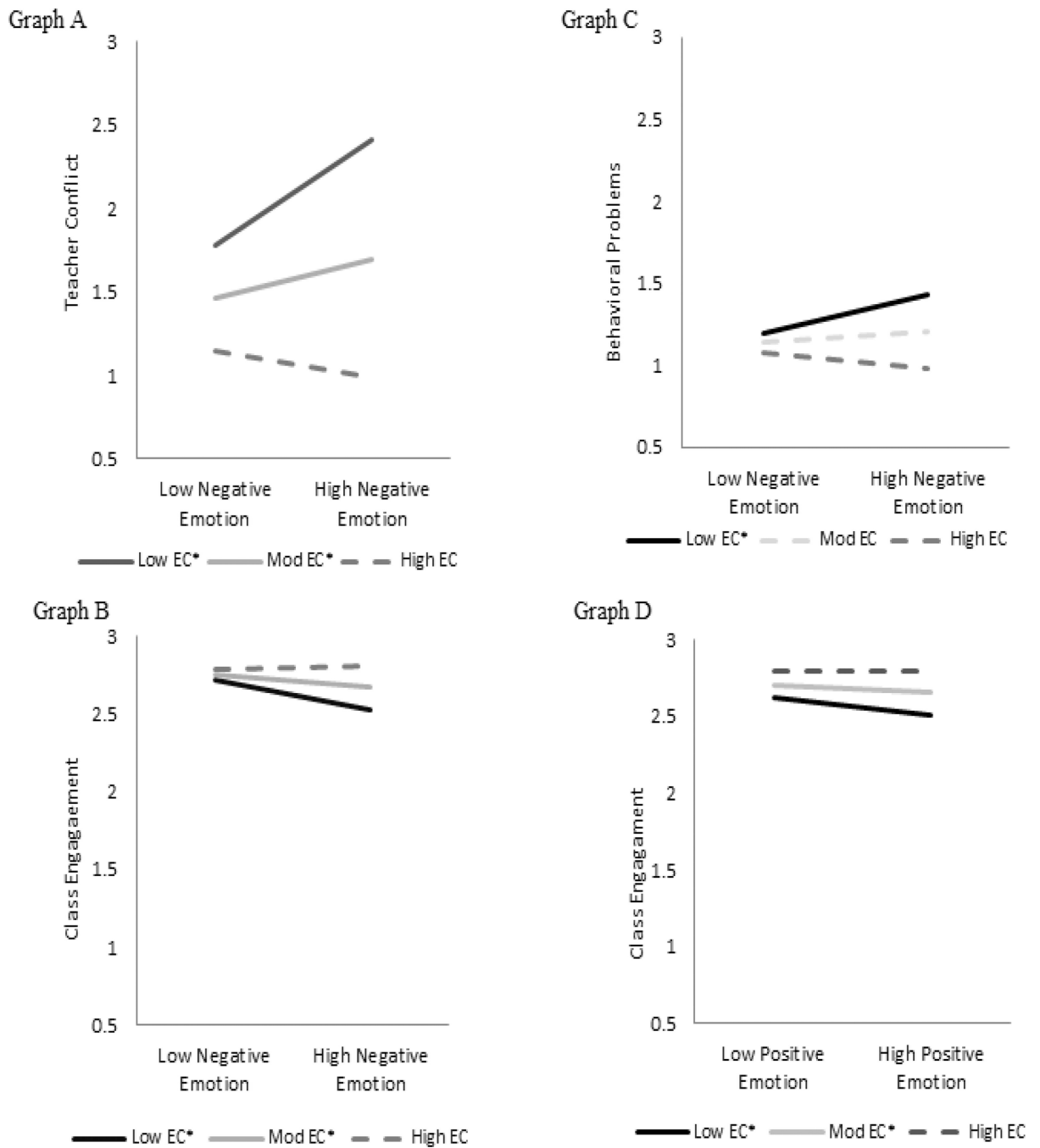


Figure 2. Children’s EC moderates the relation of emotion to teacher conflict, engagement, and behavioral problems at school. Significant simple slopes are represented by an * in the figure. Levels of EC were tested at low (–1 SD below the mean), moderate (mean), and high (+1 SD above the mean).

Table 1

Descriptive Statistics of Main Target Variables

	M	SD	Range
Observed negative emotion	.08	.08	.00 – .59
Observed positive emotion	.94	.30	.25 – 1.95
Effortful control			
CPT performance	2.95	.90	-.16 – 4.53
Teacher-reported effortful control	4.66	1.20	1.39 – 7.00
Parent-reported effortful control	4.80	.77	2.69 – 6.68
Observed effortful control	5.31	.97	1.43 – 6.89
Student-teacher relationship			
Student-teacher closeness	4.38	.63	1.50 – 5.00
Student-teacher conflict	1.58	.87	1.00 – 5.00
Behavior problems	1.16	.29	1.00 – 2.64
Observed academic engagement	2.70	.21	1.53 – 2.98

Table 2

Correlations Among the Key Study Variables

	1	2	3	4	5	6	7	8	9	10	11	12
1. Age	-											
2. Sex	.12*	-										
3. Ethnicity	.13	-.09	-									
4. SES	-.10	.10*	-.38***	-								
5. Percent of observations	.03	.06	.03	-.09	-							
6. Negative emotion	-.09 ⁺	-.10	-.05	.03	-.17*	-						
7. Positive emotion	.06	.05	.08	-.14	-.09	-.03	-					
8. EC	.09	-.18***	-.05	.15 ⁺	-.12 ⁺	-.25***	.06	-				
9. Academic Engagement	.06	-.05	.02	-.01	.06	-.37***	-.08	.47***	-			
10. Teacher closeness	.06	-.10	-.04	-.004	.01	-.01	-.004	.22*	.13	-		
11. Teacher conflict	.05	.05	-.01	-.07	.06	.31***	-.04	-.61***	-.41***	-.37***	-	
12. Behavior problems	.04	-.09	.09	-.13 ⁺	.04	.29***	-.06	-.51***	-.38*	-.16 ⁺	.76***	-

Note: Sex was coded 0 (female) and 1 (male); Ethnicity was coded 0 (non-Hispanic) and 1 (Hispanic);

⁺ $p < .10$,

* $p < .05$,

*** $p < .01$