

Classroom Emotional Climate, Student Engagement, and Academic Achievement

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The emotional connections students foster in their classrooms are likely to impact their success in school. Using a multimethod, multilevel approach, this study examined the link between classroom emotional climate and academic achievement, including the role of student engagement as a mediator. Data were collected from 63 fifth- and sixth-grade classrooms ($N = 1,399$ students) and included classroom observations, student reports, and report card grades. As predicted, multilevel mediation analyses showed that the positive relationship between classroom emotional climate and grades was mediated by engagement, while controlling for teacher characteristics and observations of both the organizational and instructional climates of the classrooms. Effects were robust across grade level and student gender. The discussion highlights the role of classroom-based, emotion-related interactions to promote academic achievement.

Keywords: emotional climate, emotional support, engagement, achievement

Student engagement is vital to academic achievement. Engaged students are attentive and participate in class discussions, exert effort in class activities, and exhibit interest and motivation to learn (Fredricks, Blumenfeld, & Paris, 2004; Marks, 2000; Skinner & Belmont, 1993). Disengaged students become disruptive, are less likely to aspire to higher educational goals, have lower grades, and are more likely to drop out of school (Kaplan, Peck, & Kaplan, 1997). Students who are not engaged also are more passive learners and report being bored, anxious, or even angry about being in the classroom (Skinner & Belmont, 1993). Effective learning is therefore contingent upon the extent to which students are engaged in classroom learning activities (Chen, 2005; Finn & Rock, 1997; Osterman, 2000; Q. Wang & Pomerantz, 2009). In one study, middle school students who reported higher levels of engagement were 75% more likely to have higher grades and attend school regularly than those with lower levels of engagement (Klem & Connell, 2004). How then can educators help students become more engaged and, ultimately, more academically competent?

Student engagement and academic achievement often are viewed as individual student attributes or traits but not as outcomes of how teachers structure their teaching (Urduan & Schoenfelder, 2006). Seeking to move beyond teacher demographics and creden-

tials as predictors of student engagement and performance, which have limited associations with student success (e.g., Gilliam & Marchesseault, 2005; Huang & Moon, 2009), researchers are focusing their efforts on examining teacher–student interactions or classroom social processes that promote student outcomes (Brophy, 1986, 1988; Patrick, Ryan, & Kaplan, 2007; Pianta, La Paro, & Hamre, 2008). The instructional and organizational aspects of the classroom environment are well studied and include a teacher’s ability to encourage higher order thinking (Zohar & Dori, 2003), connect and integrate prior knowledge into instruction (Vermette et al., 2001), and set well-defined parameters for classroom behavior (Emmer & Stough, 2001). A third, key aspect of teacher–student interactions pertains to the teacher’s ability to cultivate an emotionally supportive classroom climate (Battistich, Schaps, & Wilson, 2004; Solomon, Battistich, Watson, Schaps, & Lewis, 2000), which is the focus of this study.

Classroom Emotional Climate

The ecological model of child development posits that the quality of interactions between the child and elements in the child’s proximal environments influence developmental outcomes (Bronfenbrenner, 1977; Bronfenbrenner & Morris, 1998). The classroom is a primary microcontext in which students and teachers interact. The quality of social and emotional interactions in the classroom—between and among students and teachers (e.g., teacher and peer support, student autonomy)—creates the classroom emotional climate (CEC; Daniels & Shumow, 2003; Jia et al., 2009; Pianta, La Paro, & Hamre, 2008; Ryan & Patrick, 2001). CEC is expected to influence learning outcomes for students (Brophy, 1986, 1988; Konstantopoulos, 2009; Stuhman & Pianta, 2009). In this section, we explore the characteristics of CEC and begin to explicate how those characteristics may lead to key academic outcomes for students.

According to the Teaching Through Interactions Framework (Hamre & Pianta, 2007), classrooms characterized as high in CEC

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have (a) teachers who are sensitive to students' needs; (b) teacher–student relationships that are warm, caring, nurturing, and congenial; (c) teachers who take their students' perspectives into account; and (d) teachers who refrain from using sarcasm and harsh disciplinary practices. Such classrooms also are ones in which the teacher fosters student comfort and enjoyment by regularly expressing warmth toward, respect for, and interest in students and by encouraging their cooperation with one another. Teachers in classrooms high in CEC also are aware of their students' emotional and academic needs and respond to their students by choosing age-appropriate activities that both encourage self-expression and cater to their interests and points of view.

In contrast, classrooms with a negative emotional climate (i.e., low CEC) are ones in which teachers and students share little emotional connection and regularly disregard, disrespect, taunt, humiliate, threaten, or even physically lash out at one another. Teachers in such classrooms do not design or apply lessons with students' perspectives or cognitive capabilities in mind, nor do these teachers divert from a lesson plan when students' boredom, discomfort, or confusion arises. Classroom emotional climates characterized as “neutral” have teachers and students who provide inconsistent regard for each other. The teacher may be moderately warm, respectful, and aware of students' emotions but also may be controlling or dismissive at times. Students in these classrooms sometimes share with and assist one another or laugh and smile with their teacher, but at other times are insensitive and uncertain about how to approach their teacher.

Classroom Emotional Climate and Academic Achievement

Why would CEC be instrumental to student achievement? Self-determination theory posits that students are more likely to succeed in school when their needs for relatedness, competence, and autonomy are met (Connell & Wellborn, 1991). Teachers who create classrooms high in CEC regard student perspectives, encourage positive interactions, and provide students with the mental space and confidence for learning to occur (cf. Skinner & Belmont, 1993). In turn, students are more likely to be engaged in the learning process (NICHD Early Child Care Research Network, 2005; Patrick et al., 2007; Skinner, Wellborn, & Connell, 1990; Wentzel, 1997). From the earliest years of schooling, students who have a greater emotional bond with their teacher are more engaged in learning (Birch & Ladd, 1997; Hamre & Pianta, 2001), even after controlling for academic performance (Wentzel, 1997).

Accumulating evidence provides support for the significance of CEC in student outcomes. Students in emotionally supportive classrooms report greater interest, enjoyment, and engagement (Curby et al., 2009; Marks, 2000; Rimm-Kaufman, La Paro, Downer, & Pianta, 2005; Skinner & Belmont, 1993; Wentzel, 1998; Woolley, Kol, & Bowen, 2009). Students who report having better quality relationships with their teachers, another characteristic of emotionally supportive climates, also report being about three times more engaged than students who report having poor relationships (Klem & Connell, 2004). Students in emotionally supportive classrooms environments also tend to choose more complex cognitive activities (Howes & Smith, 1995) and perform better academically, as evidenced through both grades (Rimm-Kaufman & Chiu, 2007; Wentzel, 1998) and standardized test

scores (LaRocque & Mvududu, 2008). Finally, large-scale longitudinal studies, such as the National Institute of Child Health and Human Development Study of Early Child Care (NICHD-SECC) have reported that observed CEC predicts standardized achievement scores in reading (Pianta, Belsky, Vandergrift, Houts, & Morrison, 2008; Rudasill, Gallagher, & White, 2010). Other studies, however, failed to replicate these findings (Hamre & Pianta, 2005; Hindman, Skibbe, Miller, & Zimmerman, 2010; Mashburn et al., 2008). Clearly, more research is needed.

In summary, accumulating evidence suggests that when teachers create a sense of community, respond to students' needs, and foster positive relationships—all of which are indicative of classrooms with high CEC—academic success likely ensues, perhaps because students are more engaged and enthusiastic about learning.

The Present Study

The research reviewed thus far suggests that high-quality teacher–student relationships matter to student learning and, more specifically, that classrooms with high CEC are likely to promote both student engagement and academic achievement. Current research on the relationship between CEC, student engagement, and academic achievement is limited in at least three ways: (a) Research has not tested mediational models to examine whether student engagement is a mediator of the relationship between CEC and academic achievement; (b) multimethod assessments have not been employed within the same study to reduce common method variance; and (c) there is a lack of clarity about the type of student outcome being assessed, be it engagement or achievement, and its relation to the context in which quality of interactions are being measured. We expand upon these points next.

Past research has shown interrelationships among CEC, student engagement, and achievement (e.g., Fredricks et al., 2004; O'Connor & McCartney, 2007; Perry, Liu, & Pabian, 2009; M.-T. Wang & Holcombe, 2010; Wentzel, 1998; Woolley et al., 2009). However, large-scale studies have yet to examine student engagement as the possible mechanism by which CEC and academic achievement are linked using a multimethod approach.

Previous research has measured CEC primarily with student ratings (with the exception of Hamre & Pianta, 2005; Hindman et al., 2010; and Mashburn et al., 2008), making inflated associations between climate ratings and engagement a concern due to common method variance. Student ratings of CEC also are problematic because they make the unit of analysis unclear. Ideally, measurement and analytical techniques are matched to the unit of analysis (Raudenbush & Bryk, 2002). Because CEC is a setting-level variable (i.e., a variable that encompasses interactions between and among teachers and students within a context), measurement and analysis need to occur at the setting level, not the student level (Seidman, Tseng, & Weisner, 2006). Student-level assessments of a setting-level construct need to be nested, a technique not employed regularly in previous research (Lüdtke, Robitzsch, Trautwein, & Kunter, 2009). Multilevel modeling procedures, such as those used in the present study, account for nested data (i.e., students nested within classrooms).

Finally, prior studies have been unclear about whether observations and student reports of engagement are linked to a specific content area or teacher (e.g., O'Connor & McCartney, 2007; Pianta, Belsky, et al., 2008; Rudasill et al., 2010). For example, if

CEC was measured in a science class, then students' science grades but not their social studies grades would likely be associated with CEC. Because of the variability in student-teacher interactions from classroom to classroom, it is important to examine relationships between the emotional climate, engagement, and performance within the same classroom or content area. In the present study, we selected one content area, English language arts (ELA).¹ We then assessed CEC, student engagement, and academic performance within that ELA class.

In summary, the present research extends previous research by employing a multilevel mediation approach (Krull & MacKinnon, 1999; MacKinnon, 2008) to examine whether student ratings of engagement mediate the relationship between CEC and year-end grades in a core content area, ELA. Following the steps in mediation (Baron & Kenny, 1986; MacKinnon, 2008), we tested the following hypotheses: (a) classrooms with higher observed CEC ratings have students with higher year-end report card grades, (b) classrooms with higher CEC ratings have higher student ratings of engagement, and (c) the relationship between CEC and grades is mediated by student-rated engagement. In addition, we hypothesized that all these relationships would remain statistically significant when teacher characteristics and both classroom organizational and instructional climates were held constant.

Method

Participants

Data were collected from 63 teachers and 2,000 students in 90 fifth- and sixth-grade ELA classrooms from 44 schools in a diverse school district in the Northeastern United States. These classrooms met the inclusion criteria of having a complete data set of observational data (i.e., videotapes), student survey data, and report card data. The original sample included 155 classrooms. Sixty classroom teachers either did not consent to be videotaped ($n = 28$ classrooms) or failed to return videotapes ($n = 32$ classrooms). Five did not return report card grades because their schools were closed. Thus, the participating sample included 58% of the available classrooms. Participant characteristics are summarized in Table 1. Differences between included and excluded samples are discussed in the Analysis section. Of the 63 teachers who returned usable videotapes, 27 taught more than one classroom and returned data for more than one classroom. To retain a 1:1 correspondence between teachers and classrooms, we selected randomly one classroom from each of these 27 teachers. The multilevel mediation analyses reported in this article were based on 63 classrooms and 1,399 students.²

The schools in the included sample had student populations, on average, that were 12% English language learners, 28% recipients of free or reduced lunch, 73% minority status in terms of race/ethnicity, and 31% with low reading achievement. The average student-to-teacher ratio in these schools was 25:1. The teachers in the included sample were 89% female and had been teaching for an average of 15 years with over 9 years of experience at their current school. Approximately 41% of teachers had earned master's degrees, 36% of teachers had earned bachelor's degrees, 14% were working toward master's degrees, and 3% had earned degrees higher than master's. The students in the included sample were, according to the school records, 50% female and racially/ethnically diverse, with approximately 33% Black/African Amer-

ican, 29% Hispanic, 25% White/non-Hispanic, 12% Asian/Pacific Islander, and <2% multiracial or Native/Aboriginal.

Procedures

Observational data were collected using Sony DCR-HC38 digital camcorders and Sony DVM 60-min mini-DV tapes. Consenting teachers received video equipment (camera, tapes, and a tripod) and brief instructions to record their entire class on three separate days during a 2-week period. They were instructed to select lessons involving "vocabulary or grammar lessons, discussions about classroom books, small group projects and presentations, poetry lessons, or other basic or creative lessons" and to "refrain from taping classes in which students are completing a test or quiz." Teachers positioned the cameras at an angle where at least their profiles and most of their students' profiles were visible and turned the camera on at the start of their class and off at the end. Students with no parental consent were not visible. Teachers returned their tapes directly to the laboratory using preaddressed, prepaid mailers. Ten members of our laboratory, including a post-doctoral fellow and research associates, assistants, and aides attended a 2-day training to become certified coders on the Classroom Assessment Scoring System (CLASS) and used the CLASS to code the videos (see technical manual for more information; Pianta, La Paro, & Hamre, 2008). Each video included approximately 30 min of footage from class sessions, which were mostly of the same length and centered on literary works, grammar, or vocabulary. Lesson content did not vary systematically between schools or between grades. To ensure that all coders would start and end coding at exactly the same point, we converted the footage to a DVD format. Because the CLASS is designed to code 10–20-min segments, during the conversion we divided the footage into two segments of equal length ($M = 14.8$ min, $SD = 1.39$). Segments had to be at least 10 min in length to be coded; otherwise, they were discarded. We asked each teacher to tape for three class sessions; thus, for each classroom, we acquired up to six segments (two segments for each of the three sessions).

To maintain reliability and prevent coding drift, four coders underwent additional training to become certified CLASS trainers and led weekly meetings with the other coders for the duration of coding. If a coder did not demonstrate reliability during these sessions (i.e., within 1 of master code), the trainers worked with the coder until reliability was achieved and maintained. A coder was not allowed to code until reliability was achieved and maintained. As another mechanism to ensure reliability, we quadruple coded a randomly selected 40% of the segments.

Student ratings of engagement were drawn from surveys administered by research assistants who collected data from students during the regular school day. Research assistants read each item within the survey and the response options aloud as the students responded to

¹ This study uses baseline (prior to randomization and program receipt) data from a large, cluster randomized control trial examining the impact of an evidence-based social and emotional learning program, The RULER Approach (Brackett et al., 2009; Brackett, Rivers, Reyes, & Salovey, in press; Rivers & Brackett, 2011), on classroom social processes and student outcomes. Because The RULER Approach was implemented across only fifth- and sixth-grade ELA classes, data used in the analyses were limited to those classrooms.

² The results from the full sample, which were similar to the results reported here, are available from the authors upon request.

2008). Each domain is a composite of three or four dimensions, which are scored on a 7-point scale (1–2 = *low*, 3–5 = *mid*, 6–7 = *high*) based on the presence or absence, frequency, and quality of specific observable indicators. In accordance with the CLASS, observers assessing and coding the climate of classrooms were trained to disregard the content of lessons and to focus on the teacher's emotional, organizational, and instructional approaches (described in more detail below).

Emotional support or CEC, the primary domain of interest in this study, examines the extent to which the classroom climate is characterized by positive relationships, enjoyment and excitement, feelings of comfort, and experiences of appropriate levels of autonomy. It consists of the dimensions of *positive climate* (degree of warmth and connection observed in the classroom), *negative climate* (degree of negativity observed in the classroom; reverse-coded), *teacher sensitivity* (teacher's awareness and responsiveness to students' academic and social needs), and *regard for student perspectives* (degree to which the classroom is focused on students' interests and motivations).

Classroom organization assesses teachers' classroom management strategies: the ways in which teachers structure students' behavior, time, and attention in the classroom. It consists of the dimensions *behavior management* (teachers' efficient and effective use of behavior management techniques), *productivity* (teachers' management of time to maximize learning opportunities), and *instructional learning formats* (teachers' use of methods to maximize students' engagement).

Instructional support encompasses the ways in which teachers implement lessons and activities that promote higher order thinking skills. It consists of the dimensions of *concept development* (teachers' promotion of higher order thinking in the classroom), *quality of feedback* (degree to which teachers' feedback promotes further understanding and participation), and *language modeling* (degree to which teachers support students' language development).

Coders assigned dimension scores for each segment based on the observed indicators. (Details on how dimension scores are calculated can be found in the CLASS technical manual; Pianta, La Paro, & Hamre, 2008.) We computed average scores among all segments of a given classroom, including the 40% of segments that were quadruple-coded. We then calculated domain scores for each segment for a classroom by averaging the dimension scores. Domain (and dimension) scores for each climate variable were further averaged across all segments of a given classroom to obtain three total classroom climate scores. Interrater reliability for each domain was established by calculating intraclass correlation values (α), which indicated adequate to high levels of interrater agreement, with α s = .83, .83, and .78, for CEC, classroom organization, and instructional support, respectively.

Student engagement. The Engagement vs. Disaffection Scale (Furrer & Skinner, 2003) examines students' perceptions of their effort, interest, and enjoyment while initiating and sustaining learning activities. We modified the original items so that they related specifically to engagement in ELA. This eight-item scale consists of four items each under engagement (e.g., "I feel good when I'm in my ELA class") and disaffection (e.g., "I get discouraged when we work on something in my ELA class"). Students reported the extent to which they agreed with each statement using a 5-point Likert-type scale (1 = *disagree a lot*; 5 = *agree a lot*).

We computed a composite score by adding the responses to each item on the scale after first reverse scoring the disaffection dimension (Cronbach's $\alpha = .85$). Higher scores reflected greater student engagement. This scale correlates with related constructs such as student perceptions of positive classroom relationships (Furrer & Skinner, 2003).

Academic achievement. We measured academic achievement in ELA ("grades") through year-end report cards (with a highest possible grade of 100) obtained from each school. All teachers used the same report card format, which included seven scores for ELA: (a) reading, (b) writing forms/skills, (c) listening, (d) speaking, (e) conduct, (f) homework, and (g) effort. By averaging these scores, teachers created an "overall grade for ELA." Report cards provide a valid indicator of academic achievement. Research shows that fifth-grade students' grades correlate moderately with standardized test scores ($r = .64$; Martínez, Stecher, & Borko, 2009) and are distinct from teacher reports of student psychosocial functioning (Baker, Mednick, & Hocevar, 1991).

Covariates. Student-level covariates included gender (0 = *female*, 1 = *male*) and race/ethnicity (0 = *White/Caucasian*). Gender was included as a potentially confounding covariate because girls tend to be more engaged and have higher grades than boys (Anderman & Anderman, 1999; Furrer & Skinner, 2003; Skinner, Furrer, Marchand, & Kindermann, 2008). Student race was included because race has been linked to motivation, with studies showing that Black/African American students have higher levels of engagement and motivation compared with White/Caucasian students, despite the former's tendency to perform more poorly than the latter students (Shernoff & Schmidt, 2007). Classroom-level covariates included grade level (0 = *fifth grade*; 1 = *sixth grade*) and CLASS scores on classroom organization and instructional support (described above), the latter of which have been associated positively with engagement (Pianta, La Paro, & Hamre, 2008) and academic achievement (Hamre & Pianta, 2005; Mashburn et al., 2008).

Teacher demographics and characteristics may be additional confounding variables. Thus, we assessed several teacher demographic and individual difference variables that may influence the relationships between the constructs of interest (i.e., CEC, student engagement, and academic achievement). In terms of teacher demographics, we examined the number of different class sections the teacher taught, the teacher's educational attainment (highest degree earned), gender, years teaching total, and years teaching at the current school.

In terms of individual-difference characteristics among teachers, we assessed teacher burnout and teaching efficacy. Teacher burnout has been associated with lower self-rated emotional intelligence (Brown, Jones, La Russo, & Aber, 2010), which is associated with teacher performance. Moreover, teachers who suffer from burnout offer students less information and praise, are less accepting of students' ideas, and interact less frequently with students (Travers & Cooper, 1986), all of which may be related to CEC. Finally, teacher efficacy has been linked to positive classroom climate and student outcomes (Tschannen-Moran, Hoy, & Hoy, 1998).

Teacher burnout was assessed with the 22-item Maslach Burnout Inventory—Educators Survey (MBI-ES; Maslach, Jackson, & Leiter, 1996). The MBI-ES assesses the frequency (1 = *never*; 7 = *everyday*) with which teachers experience the three aspects of burnout: *emotional exhaustion* (feelings of being emotionally drained from work), *depersonalization* (impersonal feelings toward students and coworkers), and (reduced feelings of) *personal*

accomplishment (feelings of competence and achievement). Unlike the other two subscales, higher scores on personal accomplishment correspond to lower degrees of experienced burnout.

Teaching efficacy was assessed with the five-item Adaptive Efficacy Scale (Search Institute, 2006), which measures teachers' beliefs in their ability to modify their teaching methods as needed and to have a positive effect on student achievement. Teachers rate the extent to which they agree or disagree with each statement (e.g., "When a student has trouble learning something new, I try a new strategy") using a 5-point Likert-type scale (1 = *strongly disagree*; 5 = *strongly disagree*). Cronbach's α s for emotional exhaustion, depersonalization, personal accomplishment, and teaching efficacy were .92, .64, .75, and .77, respectively.

Analysis

Preliminary diagnostics. We inspected the distributional properties of each variable to assess assumptions of normality. All variables used in the analyses met the guidelines for normality (skewness < 2, kurtosis < 7; see West, Finch, & Curran, 1995).

Differences between included and excluded samples. Table 1 shows school, teacher, and student characteristics for both the included and excluded samples. We ran hierarchical generalized linear models (Raudenbush & Bryk, 2002) to estimate the degree of bias between included and excluded samples by nesting classrooms (with teacher characteristics and aggregated student data) within schools. To gauge the magnitude of variation between the two samples, we estimated a model with Level 1 teacher characteristics and aggregated student data on engagement and year-end grades, as well as Level 2 school level demographics ($\gamma_{00} = -0.69$, $SE = 0.76$, $p = .370$; $\tau_{00} = 0.99$, $SE = 0.97$, $p = .048$). Results showed that the odds of teachers returning videotapes increased when they felt more self-efficacious about their teaching ($\gamma = 1.37$, $SE = 0.63$, $p = .033$; odds = 3.94, probability = .89) and when their schools had lower percentages of English language learners ($\gamma = -0.03$, $SE = 0.01$, $p = .041$; odds = 0.97, probability = .33).

We then ran a two-level hierarchical linear model (HLM; Raudenbush & Bryk, 2002), nesting students within classrooms to estimate the degree of bias in student engagement and grades. The difference between included and excluded students in student engagement scores was $\gamma_{01} = 0.16$ ($SE = 0.07$, $p = .017$), indicating that students with higher engagement scores were more likely to be included. There were no significant differences in grades between included and excluded students ($\gamma_{01} = -0.28$, $SE = -0.29$, $p = .698$).

Maximizing power. Because teacher characteristics could potentially confound our results, we followed recommendations from Raudenbush, Martinez, and Spybrook (2007) to determine the best set of classroom-level covariates to include by limiting the number of covariates to increase power. We ran exploratory analyses in HLM to determine which set of classroom covariates might be associated with our outcomes. Results indicated that only *years at school*, *depersonalization*, and *teaching efficacy* were potential confounds. All other teacher characteristics were excluded from the analyses.

Multilevel mediation modeling. Because of the nested design of the study, we analyzed the data using HLM with full-information maximum-likelihood estimation. Students (Level 1)

were nested within classrooms (Level 2).⁴ To test for multilevel mediation, we followed established procedures (MacKinnon, 2008) that are similar to those in simple mediation but are interpreted in a multilevel fashion (Krull & MacKinnon, 1999; Preacher & Hayes, 2008).

First, the independent variable (*CEC*) must correlate with the dependent variable (*Grades*): coefficient c in Equation 1.

$$\text{Level 1: } Grades_{ij} = \beta_{0j} + r_{ij}$$

$$\text{Level 2: } \beta_{0j} = \gamma_{00} + c(CEC)_j + u_{0j} \quad (1)$$

Second, the independent variables (*CEC*) must be associated with the mediator (*Engagement*): coefficient a in Equation 2.

$$\text{Level 1: } Engagement_{ij} = \beta_{0j} + r_{ij}$$

$$\text{Level 2: } \beta_{0j} = \gamma_{00} + a(CEC)_j + u_{0j} \quad (2)$$

Third, the mediator must be associated with the dependent variable (*Grades*) when the independent variable (*CEC*) is controlled: coefficient b in Equation 3. Finally, the association between *CEC* and *Engagement* must be nonsignificant: coefficient c' in Equation 3.

$$\text{Level 1: } Grades_{ij} = \beta_{0j} + b(Engagement)_{ij} + r_{ij}$$

$$\text{Level 2: } \beta_{0j} = \gamma_{00} + c'(CEC)_j + u_{0j}$$

$$\beta_{1j} = \gamma_{10} \quad (3)$$

Using Krull and MacKinnon's (1999) terminology, the final model was represented as a 2→1→1 model, where a Level 2 variable affects a Level 1 mediator, which in turn affects a Level 1 outcome variable. The multiplication of paths a and b calculates the indirect effect of *CEC* on grades through engagement, the mediator (see Figure 1). Partial mediation is the case when the path from *CEC* to grades is reduced and statistically different from zero with the mediator (i.e., engagement) in the model. Complete mediation is the case when the said path is no longer significant with the mediator present.

Equation 4 represents the final multilevel equation we used in the analyses, which includes the covariates.

$$\begin{aligned} \text{Level 1: } Grades_{ij} = & \beta_{0j} + \beta_{1j}(Boy)_{ij} \\ & + \beta_{2j}(Black)_{ij} + \beta_{3j}(Hispanic)_{ij} \\ & + \beta_{4j}(Other\ race)_{ij} \\ & + \beta_{5j}(Engagement)_{ij} + r_{ij} \end{aligned}$$

⁴ We employed a two-level model, as opposed to a three-level model that included schools as the third level because (a) in some cases there was only one classroom per school and (b) with other Level 1 and Level 2 covariates in the model, school characteristics did not significantly impact the outcomes. Thus, to create a more parsimonious model, we decided to use a two-level model.

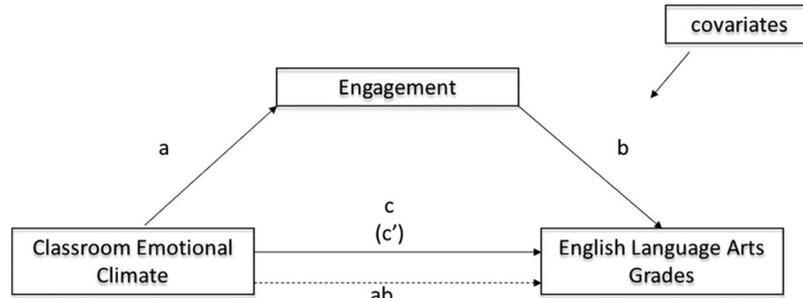


Figure 1. Conceptual model: How engagement mediates the association between classroom emotional climate and academic achievement.

$$\begin{aligned}
 \text{Level 2: } \beta_{0j} = & \gamma_{00} + \gamma_{01}(\text{Years at school})_j \\
 & + \gamma_{02}(\text{Depersonalization})_j \\
 & + \gamma_{03}(\text{Teaching efficacy})_j \\
 & + \gamma_{04}(\text{Grade6})_j + \gamma_{05}(\text{Classroom Organization})_j \\
 & + \gamma_{06}(\text{Instructional Support})_j + \gamma_{07}(\text{CEC})_j \\
 & + u_{0j}\beta_{pj} = \gamma_{p0} \text{ for } p > 0
 \end{aligned} \quad (4)$$

In Level 1 of the two-level model, ELA grades (*Grades*) for a student (*i*) who was in classroom (*j*) is a function of the mean ELA grade in this classroom (β_{0j}) after adjusting for students' gender (β_{1j}), race/ethnicity (β_{2j} , β_{3j} , and β_{4j}), the presence of the mediator (β_5), and the error term associated with this estimated mean (r_{ij}). Level 2 specifies the second-level model that the adjusted mean ELA grade for students in each classroom (β_{0j}) is a function of the grand mean ELA grade (γ_{00}), teachers' years at school (γ_{01}), depersonalization (γ_{02}) and teaching efficacy (γ_{03}), classroom grade level (γ_{04}), classroom climate scores (γ_{05} , γ_{06} , and γ_{07}), and the error term associated with this estimated mean (u_{0j}). The variances of each of the predictors were constrained to be equal across classrooms. Either grand- or group-mean centering may be used to examine the differential influence of a variable at Levels 1 and 2 (Enders & Tofighi, 2007), but grand-mean centering is preferred when between-classroom effects are of theoretical interest (Preacher, Zyphur, & Zhang, 2010). Furthermore, because grand-mean centering is a more parsimonious interpretation of the intercept, variables were grand-mean centered, except for dummy variables (i.e., gender, race/ethnicity, and grade level), which were uncentered. Alpha was set at $p < .05$.

Nomenclature. Contrary to traditional nomenclature, path *c* is viewed as the *direct effect* (see Figure 1), given the direct association between the independent and dependent variable, and path *c'* the *mediated effect*, given the presence of the mediator in the model (cf. Brackett, Palomera, Mojsa-Kaja, Reyes, & Salovey, 2010). In addition, path *ab* is an *indirect effect* because it links the independent and dependent variables through the mediator.

Effect size. We calculated effect sizes using the formula, $\delta = \frac{\gamma}{\sqrt{\tau_{00} + \sigma^2}}$, where γ is the association between the predictor and outcome variables, and the denominator is the standard deviation of the outcome variable, where τ_{00} and σ^2 are the between- and

within-groups variances, respectively, from the unconditional model. Interpretation of δ is similar to Cohen's (1988) *d*: 0.2 is small, 0.5 is moderate, and 0.8 is large.

Missing data. Missing data were estimated using multiple imputation procedures in NORM (Schafer, 2000), which created five complete data files. The multilevel analyses were conducted for each of the five imputed data files, and coefficients and standard errors resulting from each analysis were averaged to provide estimates of the associations among our variables of interest (Schafer, 1999).

Results

Descriptive Analyses

The means for CEC, classroom organization, and instructional support were 4.93 ($SD = 0.56$), 5.55 ($SD = 0.59$), and 3.09 ($SD = 0.67$), respectively. Table 1 includes the means and standard deviations for all other variables. Table 2 presents the intercorrelations among study variables. Among Level 1 variables, higher levels of student engagement were associated with higher grades. Among Level 2 variables, sixth-grade classrooms had lower scores on CEC and classroom organization than fifth-grade classrooms. Moderate to strong positive correlations were found among the three CLASS domains.

As Table 3 shows, classrooms accounted for 17% of the variance in grades and 19% of the variance in student engagement. The next section focuses on the multilevel mediation analyses.

Multilevel Mediation Analyses

Establishing direct effects (Steps 1 and 2). As Table 3 shows (Step 1), there was a significant main effect of CEC on grades after controlling for all covariates ($t = 3.72$, $p = .001$, $\delta = .39$), such that higher levels of CEC in the classroom were related to higher grades. Specifically, for every one unit increase in CEC, grades increased by 3.83 points, which corresponded approximately to half a letter grade higher (e.g., from a B to a B+).

After establishing the main effect of CEC on grades, the next step was to establish associations between CEC and the mediator, student engagement. Table 3 (Step 2) shows that higher levels of observed CEC were related to higher ratings of engagement ($t = 3.73$, $p = .001$, $\delta = .51$).

Table 2
Intercorrelations Among Variables in Two-Level Model With Students Nested Within Classrooms

Variable	1	2	3	4	5	6	7
Level 1: Students ($N = 2,000$)							
1. Black/African American	1.00						
2. Hispanic	-.44***	1.00					
3. Other race/ethnic	-.28***	-.25***	1.00				
4. Boy	-.03	.02	.02	1.00			
5. Engagement	-.05*	-.02	.12***	-.07**	1.00		
6. Grades	-.21***	-.01	.09***	-.14***	.18***	1.00	
Level 2: Classrooms ($N = 90$)							
1. Grade (1 = sixth)	1.00						
2. Years at school	-.03	1.00					
3. Teaching efficacy	-.07	-.19	1.00				
4. Depersonalization	.24*	-.18	-.33**	1.00			
5. CEC	-.22*	-.08	-.07	-.19	1.00		
6. Class organization	-.24*	-.11	-.10	.01	.60***	1.00	
7. Instruction support	.12	-.09	.05	-.15	.68***	.57***	1.00

Note. Correlations are based on one of the multiply imputed datasets. Results did not vary across different datasets. Student race/ethnicity was dummy coded, with reference variable = White/Caucasian.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Mediation analyses (Steps 3 and 4). Step 3 establishes the effect of the mediator on the dependent variable when controlling for CEC. Table 3 (final column) shows that higher ratings of student engagement were associated with higher grades ($t = 5.18$, $p < .001$, $\delta = .18$). Specifically, grades increased by 1.74 points for every unit increase in student engagement.

In Step 4, the association between CEC and grades must either be nonsignificant or of lesser magnitude when taking the mediators into account. When comparing parameter estimates of the association between CEC and grades, the final parameter estimate was of lesser magnitude than the first ($\gamma = 3.05$ vs. 3.83; $t = 2.77$, $p = .008$, $\delta = .31$), demonstrating partial mediation. Table 3 and Figure 2 show this. The final step also had a significantly better fit than the first step, as the significant $\Delta\chi^2$ specifies. Adding student engagement (Level 1) into the model significantly increased the Level 1 R^2 , from $\sigma^2 = 3.97$ to 6.76, as well.

To further test the indirect effect of CEC on grades (path ab ; see Figure 1), we followed Krull and MacKinnon's (1999) guidelines. The specific pathway from CEC to grades through engagement was indeed significant (Sobel's $z = 3.07$, $p = .002$; see Figure 2).

Additional Findings

In general, boys had lower grades ($t = -4.83$, $p < .001$, $\delta = .29$) and lower ratings of engagement ($t = -3.49$, $p = .001$, $\delta = .18$) than girls. Black/African American and Hispanic students had lower grades than White/Caucasian students ($t = -4.41$, $p < .001$, $\delta = .35$, and $t = -2.79$, $p = .008$, $\delta = .24$, respectively, for Black/African American and Hispanic students). Teachers' teaching efficacy was associated positively with student engagement ($t = 2.02$, $p = .048$, $\delta = .24$), and years teaching at school was negatively associated with engagement ($t = -2.15$, $p = .036$), although the effect size was negligible ($\delta = .01$). No other teacher or classroom characteristics, including classroom organization and instructional support, were associated with student ratings of engagement or grades.

Discussion

Consistent with our hypotheses, we found direct and indirect links between CEC and academic achievement. Student ratings of engagement mediated the relationship between observed CEC and year-end grades after controlling for the influences of school, teacher, student, and other classroom characteristics. Scores on two other observed classroom characteristics (instructional support and classroom organization) were unrelated to student engagement and grades. These findings contribute to the growing literature demonstrating the pivotal role of CEC in students' academic performance (e.g., Battistich et al., 2004; Brock, Nishida, Chiong, Grimm, & Rimm-Kaufman, 2008; Curby et al., 2009; Pianta, Belsky, et al., 2008; Voelkl, 1995; Wentzel, 1997).

CEC was measured with the CLASS instrument, which is a composite of four dimensions: positive climate, (absence of) negative climate, teacher sensitivity, and regard for student perspectives (Pianta, La Paro, & Hamre, 2008). Classrooms high in positive climate and low in negative climate are characterized by a sense of connectedness and belongingness, enjoyment and enthusiasm, and respect. Prior research shows that students in classrooms with these characteristics engage more in learning (Furrer & Skinner, 2003) and exhibit fewer problem behaviors (Crosnoe, Johnson, & Elder, 2004). Classrooms high in teacher sensitivity have teachers who are not only highly aware of and responsive to students' academic, social, and emotional needs but also are effective at helping students solve problems. When their teachers are sensitive and responsive toward both their academic and their social and emotional needs, students are more successful academically (P. A. Jennings & Greenberg, 2009). Classrooms high in regard for student perspectives are those in which teachers personally engage students in the learning process by promoting autonomy and expression of their ideas. Such classrooms have been found to be strong predictors of student engagement over time (Skinner et al., 2008). The present study extends these findings by showing that an omnibus, objective measure of CEC is related to academic performance vis-à-vis student engagement in learning. Stu-

Table 3
Mediation Analyses: Association Between CEC and Grades Through Engagement

Variable	Step 1 ^a (ICC% = 17.38) Grades ^d		Step 2 ^b (ICC% = 18.67) Engagement ^c		Steps 3 and 4 ^c Grades	
	γ	SE	γ	SE	γ	SE
Intercept	89.18***	0.73	3.78***	0.07	88.82***	0.75
Level 1 covariates						
Black/African American	-3.47***	0.73	-0.09	0.07	-3.26	0.74
Hispanic	-2.21**	0.78	0.03	0.07	-2.22**	0.80
Other race	0.13	0.97	0.09	0.08	0.02	0.94
Boy	-3.04***	0.56	-0.16**	0.05	-2.76***	0.57
Level 2 covariates						
Grade 6	-0.09	0.96	-0.16	0.10	0.21	1.02
Years at school	-0.01	0.06	-0.01*	0.00	0.01	0.06
Depersonalization	-1.06	0.87	0.08	0.06	-1.20	0.84
Teaching efficacy	0.48	1.58	0.22*	0.11	0.10	1.53
Class organization	0.07	0.94	-0.09	0.11	0.22	0.99
Instruction support	-0.66	1.02	-0.10	0.09	-0.49	1.02
Level 1 mediator						
Engagement					1.74***	0.34
Level 2						
CEC	3.83**	1.03	0.46**	0.12	3.05**	1.10
Fit statistics						
R^2 (τ_{00})		52.28		45.94		51.16
R^2 (σ^2)		3.97		0.65		6.76
AIC		10,110.78		3,446.33		10,075.03
$\Delta\chi^2$ (df)						37.75 (1)***

Note. CEC = classroom emotional climate; ICC = intraclass correlation; AIC = Akaike information criterion. Change in χ^2 compares the direct effects model (Step 1) and the mediated effects model (Steps 3 and 4).

^a Residual variance estimates: $\hat{\sigma}^2 = 75.83$; $\tau_{00} = 7.43$. ^b Residual variance estimates: $\hat{\sigma}^2 = 0.64$; $\tau_{00} = 0.08$. ^c Residual variance estimates: $\hat{\sigma}^2 = 73.63$; $\tau_{00} = 8.11$. ^d Null model variance estimates: $\hat{\sigma}^2 = 78.97$; $\tau_{00} = 16.61$. ^e Null model variance estimates: $\hat{\sigma}^2 = 0.64$; $\tau_{00} = 0.15$.

* $p < .05$. ** $p < .01$. *** $p < .001$.

dents who are engaged feel connected to both the teacher and the lesson. They participate in the learning process and obtain higher grades than students who are disengaged (Chen, 2005; Finn & Rock, 1997; Osterman, 2000; Q. Wang & Pomerantz, 2009).

Unfortunately, engagement tends to decline in early adolescence because of the disparity between students' developmental needs and the learning climate available to them (Eccles et al., 1993). In the upper elementary and middle school grades, schools often place more emphasis on competition, individualization, order, and discipline, rather than on interpersonal relationships, although the latter are crucial to positive youth development (Eccles et al., 1993; Osterman, 2000; Skinner et al., 1990). Disengaged students are more likely to

fail and drop out of school, especially when they feel alienated or disconnected from their teachers and peers (Finn, 1989). The model tested and supported in the present study shows that classrooms scoring higher on emotional climate are more likely to promote student engagement in learning, which leads to greater academic achievement.

Other Findings

Notable findings from the present study are the nonsignificant associations between the other classroom climate features (i.e., classroom organization and instructional support) and both student

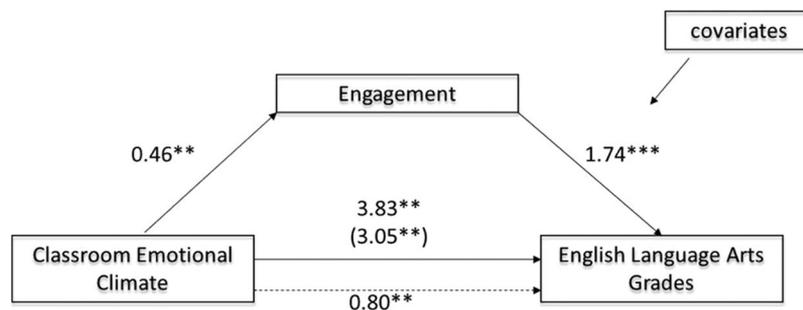


Figure 2. Mediation model: Unstandardized parameter estimates. ** $p < .01$. *** $p < .001$.

engagement and achievement. This lack of significant associations is contrary to studies showing that at least instructional climate matters to academic achievement (Hamre & Pianta, 2005; Mashburn et al., 2008). One possible explanation is that our study employed a version of the CLASS developed primarily for lower elementary classrooms. Some indicators on the elementary version may not capture the instructional or organizational climate of classrooms serving older students. For example, the language modeling dimension (i.e., degree to which a teacher exposes students to new and rich vocabulary and engages in meaningful conversations) may be less appropriate for older students than for younger students, or the rating scale may shift in its appropriateness given the type of conversations occurring among older versus younger students. Large-scale longitudinal studies also have shown that CEC is associated with students' standardized test scores in reading but not in mathematics (cf. Pianta, Belsky, et al., 2008; Rudasill et al., 2010). In future research it will be important to examine whether the CLASS dimensions have differential validity across different content areas. Further, it may be that in the middle school years, CEC is more critical to student engagement and achievement given the unique development and changes that occur with puberty and the developing adolescent brain (Eccles et al., 1993).

The present study aligns with the literature that fails to identify teacher demographics and experience as significant predictors of students' academic achievement (e.g., Mashburn et al., 2008), underscoring the pivotal role of examining the quality of classroom interactions. This is not especially surprising, in some respects, given that teachers' educational background appears to be a black box. States have varying requirements for certification, making it difficult to generalize the impact of certification on student success (Gilliam & Marchesseault, 2005; Huang & Moon, 2009). Although efforts to enhance teacher credentialing are rampant, emerging research suggests that equal time be allotted to training educators on how to cultivate optimal learning climates (NICHD Early Child Care Research Network, 2003, 2005).

Changing Student Outcomes by Changing the Classroom Emotional Climate

Student disengagement and poor performance often are attributed to the student (Urdan & Schoenfelder, 2006). For example, students are blamed for their low grades because of their laziness and lack of engagement. Although engagement can be attributed to some extent to individual student differences, more and more research, including the findings from the current study, attribute student engagement and academic performance at least in part to how teachers promote classroom interactions (Pianta, La Paro, & Hamre, 2008). Teachers who create a positive emotional climate for learning demonstrate that the classroom is a safe and valuable place to be and are enthusiastic about learning (P. A. Jennings & Greenberg, 2009). As a result, students feel more connected and engaged in learning, and become more successful academically.

This study offers additional support for the role teachers play in the emotional development of students. Children form close attachments when exposed to caregivers, including teachers who are invested emotionally in them (Shonkoff & Phillips, 2000). Caring, supportive, and emotionally available teachers have students who feel a sense of belonging and become emotionally attached and

engaged in the learning process (Battistich et al., 2004; Goodenow, 1993; G. Jennings, 2003). Indeed, from the earliest years of schooling, studies show that children's feelings of emotional bonds with a teacher are associated with engagement in classroom activities (Birch & Ladd, 1997; Hamre & Pianta, 2001). Such emotional bonds between students and their teachers are crucial to children's psychosocial adjustment and predict competencies in later life (Shonkoff & Phillips, 2000). In contrast, when students are in emotionally unresponsive learning environments, they feel disconnected from school and are less likely to be engaged. As a result, academic performance suffers.

Teacher Preparation and In-Service Training

Integrating techniques for building healthy emotional climates often are excluded in teacher preparation and professional development programs (Brackett et al., 2009). This is unfortunate because teacher emotions are linked to their sense of efficacy and classroom management strategies (Zembylas & Schutz, 2009), as well as to their job satisfaction and burnout (Brackett et al., 2010). Although educators experience a host of emotions—both pleasant and unpleasant—in their teaching, few are mindful of the impact of how their display and management of emotions impact student engagement and learning (Brackett et al., 2010). Teachers' inability to deal with emotions can lead to burnout (Maslach & Leiter, 1999) and eventually to leaving the profession (Ingersoll & Smith, 2003). Taken together, prior research findings and those reported here suggest that more deliberate and explicit forms of emotion skills training for teachers in the form of pre-service or in-service training might lead to greater student engagement, less teacher burnout, and enhanced student performance (Brackett et al., 2009; P. A. Jennings & Greenberg, 2009).

Limitations and Future Directions

Of note are some limitations on the generalization of our findings. First, our sample was biased in that it included classrooms of schools with lower rates of English language learners, classrooms whose teachers felt more self-efficacious about teaching, and students who reported higher rates of engagement than excluded classrooms. On one hand, schools with lower rates of English language learners may have students who have higher rates of engagement because engagement was in the context of ELA. On the other hand, teachers who were more self-efficacious could have been more likely to return videotapes because they perceived their students to be more engaged. The impact of our findings may have been attenuated as a result.

Second, although we showed that engagement mediated the relationship between CEC and academic achievement, there are likely other potential mediators such as self-regulatory processes, which include attention and behavior regulation (NICHD Early Child Care Research Network, 2003). For instance, when students feel emotionally supported in school, they are more likely to use self-regulatory strategies, such as planning, monitoring, and regulating their thinking, that increase their engagement in classroom tasks (Patrick et al., 2007). Indeed, future research should address self-regulatory processes as important mediators.

Third, because we used students' year-end report card grades to measure academic achievement, there is a possibility that teachers

with high CEC scores were more likely to give higher grades than teachers with low CEC scores (assuming that teachers with high CEC scores are more likely to be sensitive to students' needs and take their perspectives into account before assigning a grade). We attempted to address this issue by including teacher and classroom characteristics as covariates, which could have partially attenuated our results. Although standardized test scores are the gold standard in assessing academic performance, report card grades also are a valid indicator of academic achievement. Research shows that grades are distinct from teacher reports of student psychosocial functioning (Baker et al., 1991). A moderate correlation also exists between teacher reports of academic achievement and standardized test scores (Hopkins, George, & Williams, 1985; Martínez et al., 2009). Grades were of particular interest in this study, as they were based on what students learned specifically in their ELA classroom, whereas standardized test scores include topics that students may never have encountered. Still, an extension of our research will examine the association between CEC and standardized test scores and perhaps include grades from a previous year from another teacher as a comparison to current grades. Given that in one study, fifth-grade students' standardized reading test scores increased by as much as 3.7 points for every one unit above the mean in CEC (Pianta, Belsky, et al., 2008), we predict similar results.

Fourth, given that the teacher characteristics included in the study were weak predictors of CEC and student outcomes, one promising area in understanding student engagement and success in the classroom is examining teachers' emotion skills (Brackett et al., 2010; Zembylas & Schutz, 2009). Some teachers are more emotionally intelligent than others (Brackett et al., 2010). It is possible that teachers with high emotional intelligence are more in tune with students' needs and therefore more flexible in making the subject matter relevant to students.

Conclusion

Authentic instruction cannot take place unless teachers attend to the social and emotional aspects of learning (Brackett et al., 2009; Zins, Weissberg, Wang, & Walberg, 2004). We have shown that when a classroom climate is characterized by warm, respectful, and emotionally supportive relationships, students perform better academically in part because they are more emotionally engaged in the learning process. Our findings suggest that academic success, to some extent, is contingent upon the emotional components of learning and motivation. These findings have implications for teacher training and development and can serve as a springboard for future studies examining the relationship between teacher support, student engagement, and academic performance.

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