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The little kids down the hall: Associations between school climate, pre-K classroom quality, and pre-K children's gains in receptive vocabulary and executive function☆,☆☆

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ABSTRACT

In recent years, policymakers' and practitioners' interest in school climate as a contributor to K-12 student learning and classroom processes has increased, both in the US and internationally. However, researchers have not yet examined the influence of school climate on the youngest learners in these contexts — prekindergartners. Using data from the Boston Public Schools, where the public prekindergarten program is housed in elementary schools, we explored associations among dimensions of school climate as reported by teachers and older peers, observed measures of prekindergarten classroom quality, and gains in children's receptive vocabulary and executive function across the prekindergarten year. Student participants included 299 children attending full-day prekindergarten programs across 35 elementary schools in 61 classrooms. Findings indicated that school emotional climate had small positive association with prekindergarten classroom emotional support. School-level measures of teacher effectiveness also had positive associations with prekindergarten classroom levels of emotional support and classroom organization. School climate dimensions were not associated with children's receptive vocabulary and executive function gains across the prekindergarten year. Results are discussed in the context of current school climate research and state-wide accountability efforts to assess school quality.

1. Introduction

Interest in school climate as a contributor to K-12 student learning and classroom processes has been on the rise in the U.S. and internationally (Berkowitz, Moore, Astor, & Benbenishty, 2017; Thapa, Cohen, Guffey, & Higgins-D'Alessandro, 2013; U.S. Department of Education, 2007). Research has consistently linked a more positive school organizational climate with a host of benefits for students and teachers, including higher student academic achievement (e.g., Cornell, Shukla, & Konold, 2016; Sherblom, Marshall, & Sherblom, 2006) and less teacher turnover (Kraft, Marinell, & Yee, 2016). Motivated by these findings, school climate has increasingly become a focus of policymakers. The Every Student Succeeds Act (ESSA) recently mandated states to include a non-academic indicator of school quality across all schools, with school climate measures as one of the options for doing so (U.S. Department of Education, 2015). As of 2016, six out of 17 states that had submitted ESSA plans had chosen school climate as one of their key ESSA indicators (American Institutes for Research, 2016).

School climate indicators also have potential implications for public prekindergarten classrooms. In recent years, states and localities have expanded access to publicly funded prekindergarten programs and about half of all state- and locally-funded prekindergarten seats are in public schools (Barnett, Carolan, Fitzgerald, & Squires, 2012; Barnett, Carolan, Squires, & Clarke Brown, 2015). However, there is little research on the influence of school climate on prekindergarten classrooms and student outcomes. In

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the present exploratory study, we add to the school climate literature by examining associations between school climate and three domains of prekindergarten classroom quality (emotional support, classroom organization, instructional quality) within a diverse sample of prekindergarten children attending a full-time program in the Boston Public Schools (BPS). We also consider the role of school climate in supporting growth in children's receptive vocabulary and executive functioning – two cognitive skills that are important components of children's school readiness (Blair & Razza, 2007) – across the prekindergarten year. Given the growing attention that policymakers are paying to school climate in elementary schools, our results help fill important gaps in current understanding of the contexts that best support the classroom experiences and academic outcomes of our youngest learners.

1.1. Defining and measuring school climate and school climate dimensions

Research recognizes that a school's climate is comprised of a complex set of interrelated elements (Cohen, McCabe, Michelli, & Pickeral, 2009; Wang & Degol, 2016). The National School Climate Committee (NSCC) defines school climate as the "quality and character of school life" (NSCC, 2007) and asserts that school climate is comprised of the patterns of values, norms, and goals that are shared among a school community, including staff, teachers, students, families, and the broader community. Although there is no consensus regarding the specific dimensions of school climate, four central areas recur in empirical reviews: relationships (e.g., how connected individuals in school community feel to one another), teaching and learning (e.g., values and norms that promote student academic achievement), safety (e.g., social, emotional, intellectual, and physical security), and institutional environment (e.g., school curricular, interpersonal, and physical resources; Berkowitz et al., 2017; Thapa et al., 2013).

The University of Chicago's Consortium of School Research (CCSR) developed the most comprehensive and empirically tested school climate framework that addresses all four areas (see columns 1–4, Table 1; Bryk, Sebring, Allensworth, Luppescu, & Easton, 2010). Informed by decades of descriptive reviews of Chicago school reform efforts (Bryk, Sebring, Kerbow, Rollow, & Easton, 1998; Designs for Change, 1993), the Essential Supports of School Improvement framework (referred to as the Essential Supports framework) identifies several related but distinct school organizational elements that are most likely to support improvements in student learning: a *school leadership* element that represents the school's instructional support and how principals engage teachers and staff in school decision making processes; a *professional capacity* element that includes quality collaborations among teachers and teacher attitudes toward teaching and learning; a *parent-community ties* element that includes teachers learning about local culture and parent involvement; a *student-centered learning climate* element that addresses school safety as well as student support and engagement; and an *instructional guidance* element wherein schools focus on curricular demands and approaches to learning.

A strength of the Essential Supports framework is that the CCSR has examined the framework for individual- and school-level reliability, item difficulty, and item infit using Rasch modeling and has found it has good psychometric properties (Bryk, Sebring, Allensworth, Luppescu, & Easton, 2009, 2010; Luppescu & Ehrlich, 2012). The framework is currently implemented widely in the Chicago Public Schools and has been adopted by the NSCC and other large-scale school districts across the country (e.g., New York City). To date, this framework has not been tested in prekindergarten — a gap our study addresses.

1.2. Theoretical foundation for the influence of school climate on prekindergarten classroom quality and child outcomes

There are reasons to think that the Essential Supports framework could work equally as well in prekindergarten as it appears to in the older grades, for many of the same reasons. In their conceptualization of how the Essential Supports influence children's classroom and learning experiences, Bryk et al. (2010) theorize that the Essential Supports directly inform the dynamics of student learning, such as student motivation and school participation, and technical aspects of classroom learning, such as classroom instruction and the effective use of learning time. Thus, according to the Essential Supports framework, school climate should affect classroom quality and students' cognitive outcomes directly via the interactions teachers and students have within the classroom and broader school contexts.

The quality of teacher–student interactions is particularly important for prekindergarten children who, like some of their elementary school peers, spend most of their day embedded in their classroom context but whose classroom quality and academic gains could still be influenced by processes at the school level. For example, as related to children's classroom quality, prekindergarten students in schools with the capacity to provide effective instructional guidance (instructional guidance element in the Essential Supports framework) and retain effective teachers can benefit from teachers' collective knowledge and skills, which can directly influence classroom instructional quality. In relation to children's academic gains, schools that value input from parents and the broader community may enhance parent–teacher trust (parent–community ties essential) which could directly improve student–teacher classroom relationships (i.e., joint problem solving around academic issues) and directly influence child outcomes as parents create routines at home to support children's learning at school. Another possible direct pathway is one in which children who feel safe in school (the student-centered learning climate essential) are less distracted and can focus more attention on getting acclimated to classroom routines, such as transitioning from one classroom activity to the next and communicating with teachers and peers.

Prekindergarten is also a distinctive context in several respects. In prekindergarten, there tends to be particular emphasis on developing foundational skills, such as building a rich vocabulary to support subsequent academic learning, listening to and following spoken directions, and focusing one's attention. It is unclear if current measures of school climate are likely to capture the contextual supports that are particularly important for prekindergarten children, such as nurturing and individualized support for early language and cognitive development (Ehrlich, Pacchiano, Stein, & Luppescu, 2016). In addition, standards for prekindergarten children (e.g., language/literacy and approaches to learning standards in prekindergarten; Massachusetts Department of Early Education and Care, 2005; Michigan State Board of Education, 2005; New York State Education Department, 2011; Oklahoma Department of Education, n.d.) are different than those for older children (e.g., state standards for reading, writing, listening and speaking; National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010; Michigan Department of Education, 2017) and existing school climate measures may or may not be sensitive to these differences.

Regarding our focal child outcomes specifically – vocabulary and executive function development – schools with higher teacher professional capacity (e.g., one of the Essential Supports) might have prekindergarten teachers who employ multiple approaches (e.g., providing both oral and visual directions) when helping children who may need additional support apply new knowledge to different classroom activities and when building children's vocab-

Table 1
Areas and features of school climate research, the Essential Supports framework for school improvement (Bryk et al., 2010), and study school climate dimensions.

Central areas of school climate	Defining features	Related Essential Support(s)	Sample Essential Support indicators	BPS school climate dimensions
Relationships	Adult social support, peer social support, teacher's work environment	School leadership, faculty and professional capacity	Instructional leadership, inclusive facilitative leadership, collective responsibility, school commitment	Instructional leadership, principal effectiveness, work environment collegiality, perceptions of collective efficacy
Teaching and learning	Support for learning (e.g., academic challenge), social and civic learning	Student-centered learning climate	Academic engagement, peer support for academic work, press toward academic achievement from teachers	Enthusiasm for learning, teacher effectiveness, teacher self-efficacy, teacher influence
Safety	Rules and norms, physical security, social-emotional security	Student-centered learning climate	Safety and order	Positive emotional climate
Institutional environment	School connectedness-engagement, physical school layout and surroundings, resources and supplies	Parent and community ties, instructional guidance	Use of community resources, parent involvement in school, curriculum content and academic demands	Parent and student engagement

ulary knowledge. School climate might also operate differently on prekindergarten children's executive function (EF) gains compared to older students, given that EF skills develop particularly rapidly during the preschool period (Zelazo, Muller, Frye, & Marcovitch, 2003) and are particularly important when children first enter formal schooling and are tasked with remembering rules and directions, sitting for longer periods of time, and inhibiting prepotent responses to play with materials or speak when the teacher is speaking. Classroom processes, such as effective classroom management, are important in fostering children's EF development (Ursache, Blair, & Raver, 2012), yet little is known how school processes also support these skills.

1.3. Empirical evidence linking school climate to classroom quality and child outcomes

Empirically, there has been little work examining the central school climate areas of teaching and learning, safety, and institutional environment – e.g., the influence(s) of these areas on classroom-level processes – in any grade. At the prekindergarten level, there has been some work linking school climate-like constructs related to organizational relationships, such as teacher collegiality and supervisor support, to classroom quality (e.g., Dennis & O'Connor, 2013; Zinsser & Curby, 2014), though none of these studies was based explicitly on the Essential Supports framework. So far, prekindergarten findings regarding relational aspects of school climate have been mixed, with some studies showing positive associations between school climate and global measures of classroom quality (Dennis & O'Connor, 2013; Lower & Cassidy, 2007) and some showing no or inconsistent associations between school climate and measures of classroom quality focused on teacher–child interactions, like emotional support (McGinty, Justice, & Rimm-Kaufman, 2008; Zinsser & Curby, 2014). Further, it is not clear that this prior work generalizes to prekindergarten programs based in public schools; most prior studies only examined community-based preschools, which do not generally include students in kindergarten and later grades, and tend to have a different structure and set of inputs than public schools (e.g., lower pay, no union-protected common planning time, more flexible arrival and departure schedules for students; Yudron, Weiland, & Sachs, 2018).

There has been far more evidence linking school climate with student academic outcomes within elementary, middle, and high school samples (though primarily, at the high school level). While no empirical work has investigated the link between school climate and students' vocabulary knowledge or executive function skills, some work has examined the influence of school climate on related outcomes such as general measures of language/literacy (e.g., rhyming, reading fluency) and standardized reading/English language arts scores. Work exploring the influence of school climate on child-level processes has been mixed. While research has generally found associations between supportive school climate and student academic outcomes from elementary school through high school (e.g., Berkowitz et al., 2017; Bryk et al., 2010; Nathanson et al., 2013; Thapa et al., 2013), some studies that include elementary school climate have found little correlation between climate and gains in student academic skills (e.g., Scott, Parsley, & Fantz, 2014). We are aware of just one relevant study that has found positive associations of adult support for academic success and school safety specifically for kindergarten children (Lowenstein, Friedman-Krauss, Raver, Jones, & Pess, 2015). In this study, the authors investigated the influence of sixth through eighth grade student-reports of adult support and safety (termed unsafe climate) on kindergarten children's academic skills and found that children in schools categorized as having low adult support were rated by their teachers as having poorer language/literacy and math skills (Lowenstein et al., 2015). This association was moderated by student–teacher relationships at the classroom level. School safety, however, was not related to kindergarten children's academic skills.

In sum, to date, there have been few empirical tests of whether dimensions of school climate influence classroom quality and of whether prekindergarten children make greater cognitive skill gains in public schools with a more positive school climate. Further, we are aware of no studies to date that have examined the associations between school climate and both classroom quality and cognitive gains — specifically receptive vocabulary and executive function, two constructs that are predictive of later academic development (Duncan et al., 2007) — during the prekindergarten year. More empirical evidence is needed, given that many young students begin their public school careers in prekindergarten and given the broader policy focus on school climate.

1.4. The present study

In the present study, we add to the school climate and prekindergarten literature by examining the relationship between school climate (as perceived by teachers and students in grades 3–8), observed prekindergarten classroom quality, and prekindergarten children's cognitive gains in programs located in public schools. We also sought to determine the reliability and validity of the school climate dimensions captured by district-wide surveys. We explored two specific research questions:

Table 2
Classroom-level teacher experience and quality and school-level covariates.

Characteristic	Mean or proportion (*SD*)	Min	Max
Classroom-level teacher experience and quality (*N* = 61 classrooms)			
Teacher had a master's degree	0.82	0	1
Teacher had 3–5 years of experience	0.09	0	1
Teacher had 5–10 years of experience	0.27	0	1
Teacher had 10+ years of experience	0.56	0	1
Spring CLASS emotional support score	5.63 (0.69)	3	6.63
Spring CLASS classroom organization score	5.14 (0.71)	2.75	6.07
Spring CLASS instructional support score	4.34 (0.93)	1.92	5.67
School-level covariates (*N* = 35 schools)			
% of 3rd graders scoring at or proficient	35.09 (17.66)	7.00	73.00
% of low income students	77.34 (13.95)	35.40	94.20
% of students with disabilities	17.97 (5.34)	10.80	37.70
% of students who are English language learners	22.10 (14.70)	2.40	53.10
% of teachers retained	85.08 (10.35)	51.80	100
Stability rate	83.73 (6.66)	62.40	95.50
Student/teacher ratio	13.67 (1.68)	9.20	17.50

Note: Stability rate is calculated as the percent of student who remain in the district/school from one school year to the next. At the classroom level, teacher education was missing for 2% of the sample and teacher years of experience were missing for 10% of the sample. All other data are non-missing.

1) Does a more supportive school climate as reported by teachers and older children (grades 3–8) predict higher observed prekindergarten classroom quality?
2) Does a more supportive school climate predict gains in prekindergarten children's receptive vocabulary and EF skills?

2. Method

2.1. Participants and setting

All children sampled in the present study were enrolled in the Boston Public School (BPS) full-day prekindergarten program (6.5 h) during the 2009–2010 academic year. The program was open to all four-year-old children living in the city of Boston, regardless of income. District guidelines required class size to be capped at 22, and classrooms to be staffed by a teacher and a paraprofessional, for a maximum teacher–student ratio of 1:11. All BPS prekindergarten teachers were subject to the same educational requirements and pay scale as K-12 teachers. Prekindergarten teachers also were required to have an early childhood (pre-K to grade 2) license from the Massachusetts Department of Elementary and Secondary Education (Jason Sachs, personal communication, December 3, 2018). As shown in Table 2, 82% of the teachers in the sample had a master's degree.

In spring 2010, 77 Boston public elementary schools administered the district's school climate survey (see Fig. 1). Of those schools, 62 served prekindergarten children. Five schools were excluded from the eligible study sample because they did not include students who completed the school climate survey (e.g., children in third grade or higher) and another three did not have complete teacher and student climate data, leaving 54 schools eligible schools for our sample. Of these, 35 had fall 2009 and spring 2010 child assessment data available, due to their participation in studies of the program's impact, and had non-missing average school-level achievement information available, a covariate included in our model (described later) that may influence the academic achievement of young children (e.g., Zhai, Raver, & Jones, 2012). Our final sample included 299 prekindergarten children from 61 classrooms across 35 schools that had prekindergarten programs and school climate data.

As shown in Table 3, focal children were diverse in their background characteristics and were approximately representative of the district's prekindergarten population. On average, 77% of students attending sample schools qualified for free- or reduced-price lunch and 46% of students were Hispanic. Children attended either

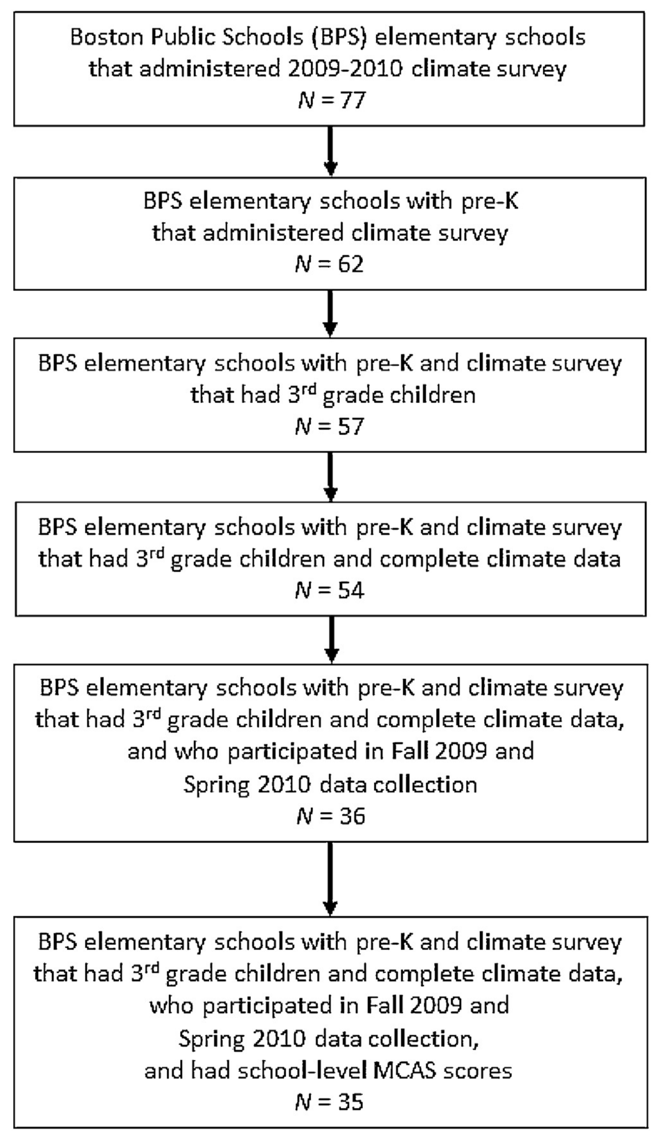

Fig. 1. Diagram of final sample of schools from Boston prekindergarten program and climate survey administration.

Table 3
Child- and classroom-level sociodemographic characteristics.

	Child-level (N = 299)			Classroom-level (N = 61)		
Characteristic	Mean or proportion (*SD*)	Min	Max	Proportion (*SD*)	Min	Max
Fall PPVT scores	45.30 (20.16)	3	105	–	–	–
Spring PPVT scores	60.36 (21.32)	9	118	–	–	–
Fall EF scores	0.49 (0.22)	0.10	0.94	–	–	–
Spring EF scores	0.60 (0.19)	0.14	0.92	–	–	–
Mobile	0.12	0	1	0.22	0	0.77
Race/ethnicity: Asian	0.13	0	1	0.10	0	1
Race/ethnicity: Black	0.28	0	1	0.29	0	1
Race/ethnicity: Hispanic	0.40	0	1	0.41	0	1
Race/ethnicity: Other	0.02	0	1	0.02	0	0.18
Male	0.52	0	1	0.48	0	0.75
Home language is Spanish	0.27	0	1	0.24	0	1
Home language is not Spanish or English	0.23	0	1	0.20	0	1
Eligible for free/reduced lunch	0.71	0	1	0.70	0.05	1
Special needs	0.12	0	1	0.12	0	0.50
East attendance zone	0.55	0	1	0.50	0	1
North attendance zone	0.21	0	1	0.22	0	1

Note: N = 299 children in 61 classrooms in 35 schools. At the child level, fall PPVT was missing for 6% of the sample and fall EF was missing for 9% of the sample. All other data are non-missing.

P-5 (N = 26) or P-8 schools (N = 9). We found two statistically significant differences between the sample population of schools included in the study and all other district schools serving 4-year-old children across eight available school-level background characteristics: percent Black (34% participating vs. 36% not participating; $p < 0.01$) and student–teacher ratio (14:1 participating vs. 12:1 not participating; $p < 0.01$).

Teachers across the BPS program classrooms implemented two curricula during the school year: *Opening the World of Learning* (OWL; Schickedanz, Dickinson, & Charlotte-Mecklenberg Schools, 2005), a language and literacy curriculum; and *Building Blocks* (Clements & Sarama, 2007a), a mathematics curriculum. Both curricula have shown positive effects on children's outcomes (e.g., Ashe, Reed, Dickinson, Morse, &, Wilson, 2009; Clements & Sarama, 2007b; Clements, Sarama, Spitler, Lange, & Wolfe, 2011). All prekindergarten teachers received curriculum-specific training before the start of the school year, specifically two days of training in Building Blocks and five days in OWL. In the previous school year, all teachers received in-classroom bi-weekly to monthly coaching (Weiland & Yoshikawa, 2013). During the 2009–2010 school year, prekindergarten teachers in schools undergoing National Association for the Education of Young Children Accreditation and new teachers received bi-weekly on-site support from an experienced early childhood coach trained in both curricula.

2.2. Procedures

Children were assessed during one-on-one pull-out sessions with trained assessors in the child's school in fall 2009 and spring 2010. In addition to demonstrating good rapport and management skills during training sessions and real testing situations, assessors had to show reliability on the battery of tests administered in the study. Study children were tested in English unless they spoke Spanish as a home language and failed practice items on the vocabulary assessment (which was the first assessment in the testing battery). Ultimately, six children in the present sample were assessed on their executive function in Spanish (sensitivity analyses in which we dropped all non-English home language children and refit our primary child-level models show our results were robust to child home language; results available upon request).

To assess classroom quality, trained independent assessors observed in study classrooms in spring 2010 for 4–5 h. These observations took place on days when general classroom routines could be observed (e.g., not on field trip days). Each assessor had to demonstrate at least 85% exact agreement with a master coder on each measure to ensure reliability. The percent exact agreement ranged from 85% to 95%.

BPS developed the school climate measure based on research on three general areas related to student learning: school's academic emphasis, teacher variables, and principal leadership (BPS Office of Data and Accountability, n.d.). The district-wide school climate surveys were administered in the spring of 2010 to students (grades 3–11), parents (grades P-12), and teachers (grades P-12). Surveys were distributed in March and returned at the beginning of May in the same year. All responses were anonymous. Teachers and parents had the option to take the survey online or via paper and pencil. All students completed the survey in school using a Scantron form. Given the low rates of response from parents (13.5%), which is consistent with the literature on parent response rates of school climate surveys (Austin, 2011), we used only the student and teacher survey responses in the present study. Student and teacher response rates were not available at the school level. However, respondent data across all BPS schools show that approximately 2246 teachers and 23,301 students responded to the climate survey, representing 53.3% of P-12 teachers and 57.5% of students in grades 3–11. Our district-level teacher response rate is slightly lower than other districts testing the influence of school-level climate on student achievement outcomes (range: 63–100%; Kraft et al., 2016; Nathanson et al., 2013; Scott et al., 2014). Reports from students and teachers were aggregated to create school-level scores, which are discussed below.

2.3. Measures

2.3.1. Classroom-level outcomes

To assess classroom quality, we used the emotional support, classroom organization, and instructional quality domain scores of the Classroom Assessment Scoring System (CLASS; Pianta, La Paro, & Hamre, 2008). The CLASS is a widely used measure with good psychometric properties. We chose it because of its focus on the aspects of quality related to teacher practice and teacher–child interactions; we theorized these would more likely be influenced by school climate than the more structural elements captured by some other commonly used measures (i.e., ECERS). The reliability of the emotional support, classroom organization, and instructional support subscales are 0.68, 0.78, and 0.93, respectively (Hamre et al., 2013).

2.3.2. Child-level outcomes

We measured children's receptive vocabulary using the *Peabody Picture Vocabulary Test III* (PPVT-III; Dunn & Dunn, 1997). The PPVT-

III is a widely used measure of receptive vocabulary that has been validated on a nationally representative sample of children and has excellent test–retest reliability. Children were shown a series of four pictures and were asked to choose the picture that corresponds to the stimulus word. For our analyses, we used the raw score for the PPVT-III, which is consistent with evaluations of publicly funded prekindergarten programs (e.g., Weiland & Yoshikawa, 2013; Wong, Cook, Barnett, & Jung, 2008).

We measured EF using a composite of three principal dimensions: working memory, cognitive inhibitory control, and attention shifting. We used the Forward Digit Span and Backward Digit Span (FDS and BDS, respectively; Gathercole & Pickering, 2000) tasks to measure working memory. During these tasks, children repeated a string of numbers in the exact order spoken by the assessor (in FDS) or in reverse order (in BDS). The tasks measure different dimensions of working memory. BDS measures the central executive component, while FDS measures the phonological loop. BDS demonstrates high correlations with other working memory tasks—both verbal and spatial (Alloway, Gathercole, Kirkwood, & Elliot, 2008; Carlson, Moses, & Breton, 2002), as well as good test–retest reliability ($r = 0.73$; Lipsey et al., 2017). FDS demonstrates high correlations with BDS and other EF tasks, and has good test–retest reliability in prekindergarten children ($r = 0.80$; Muller, Kerns, & Konkin, 2012).

Although the BDS task has been used with children as young as four (Alloway, 2007; Gathercole, Brown, & Pickering, 2003), this task has illustrated floor effects in prekindergarten samples (Bull, Epsy, & Wiebe, 2008; Carlson, 2005). In the current sample, we examined the potential for this, and found that only 13% of our sample could either not pass the practice items or had missing data on this task, and a majority of children received a score that aligns with prior mean scores in prekindergarten samples ($\sim M = 1.30$; Fuhs, Nesbitt, Farran, & Dong, 2014; Hamre, Pianta, Hatfield, & Jamil, 2014). We also did not see any performance differences in passing the practice items by home language status, which suggests that number word knowledge or language difficulty was not of concern in this task.

To assess cognitive inhibitory control, we used the Pencil Tap (Diamond & Taylor, 1996). The task calls for children to tap once if the assessor taps twice and to tap twice if the assessor taps once. The child's score corresponds to the number of items he/she got correct out of 16 possible. The Pencil Tap has demonstrated convergent and predictive validity (Blair & Razza, 2007; Lipsey et al., 2017; Rhoades, Greenberg, Lanza, & Blair, 2011) as well as test–retest reliability in prekindergarten samples (e.g., $r = 0.80$; Lipsey et al., 2017).

To measure attention shifting in the fall only, we used the Dimensional Change Card Sort (DCCS; Frye, Zelazo, & Palfai, 1995) task. For this assessment children were shown a series of cards and asked to sort the cards according to one dimension (e.g., shape, color). Then, they were asked to sort the cards based on another dimension. The DCCS total score was the number of trials out of 10 in which the child could shift attention correctly from one criterion to the next. The DCCS is "the most widely used executive function task in early childhood" (Willoughby & Blair, 2016, p. 92) and demonstrates convergent validity (Carlson, Faja, & Beck, 2015). It has also been included as a standardized measure in the NIH Toolbox where it has demonstrated construct validity (Zelazo et al., 2013).

We chose these specific EF measures because they are predictive of academic achievement (Bierman, Nix, Greenberg, Blair, & Domitrovich, 2008; Fuhs et al., 2014; Weiland et al., 2014). A recent analysis has also compared BDS, Pencil Tap, and DCCS to each other and nine other EF measures, and judged these measures on their ability to predict achievement, respond to developmental change, and relate to teacher-rated classroom behavior (Lipsey et al., 2017). BDS, Pencil Tap, and DCCS (and three other tasks) were deemed as some of the most educationally relevant measures to use during the prekindergarten period.

We created a single measure of children's EF skills in the fall and spring by taking a unit-weighted average of their FDS, BDS, Pencil Tap, and DCCS scores at each time point.[1] To standardize these scores, we divided each child's test score by the maximum score observed for each test and averaged the standardized scores separately for the fall and spring outcomes. The unidimensional factor can be interpreted as higher scores representing better overall executive functioning skills.

We chose to form a composite EF measure for several reasons. Previous evidence – including work on our sample – suggests that in the prekindergarten period, EF is comprised of a single latent factor (e.g., Barata, 2011; Fuhs & Day, 2011; Weiland et al., 2014). Further, other research has combined the specific measures we used in our study and found that including a composite score versus including separate EF components in their analyses did not change their results (Lipsey et al., 2017). Also, one study found that the test–retest reliability and developmental trajectories for EF between ages 3–5 were different depending on whether EF was measured as a composite or as individual test scores (Willoughby & Blair, 2016); they conclude that across-time stability and sensitivity to developmental changes in EF was more accurate when a composite score was used.

2.3.3. Child- and classroom-level sociodemographic covariates

We used district administrative records to obtain information about children's race/ethnicity, school mobility, gender, home language, free- and reduced-lunch status, special-needs status, and school attendance zone. We constructed a series of dichotomous indicators to represent child race/ethnicity (i.e., Asian, Black, Hispanic, White, Other), home language (i.e., English, Spanish, Other), attendance zone (i.e., north, east, west), free-reduced lunch eligibility, male, and special needs, each coded as one when the child belonged to the requisite group and zero otherwise. White was the reference group for child race/ethnicity, English was the reference group for home language, and west was the reference group for attendance zone. We chose these covariates because they have been shown to predict early cognitive and educational outcomes in the early childhood literature and thus may confound understanding of associations between school climate and the outcomes of interest in the study (e.g., Clements et al., 2011; Wong et al., 2008). Classroom-level sociodemographic variables were created using classroom aggregates of child-level variables. We created these variables to account for classroom-level factors that could be related to our outcomes of interest.

2.3.4. Teacher covariates

For teacher experience, we used a vector of dichotomous indicators calculated from administrative data that captured whether the teacher had between 0–3, 3–5, 5–10 or 10 or more years of total teaching experience. Teachers with 0–3 years of teaching experience served as the reference group. We used district administrative records to create another dichotomous variable that was set to 1 if the teacher had a master's degree and zero otherwise.

2.3.5. School-level covariates

We used data from the 2009–2010 academic year retrieved from the Massachusetts Department of Elementary and Secondary Education's School and District Reports (n.d.) as our school-level covariates. We chose covariates that theory and prior litera-

[1] Previous factor analytic work with this sample (Weiland & Yoshikawa, 2014) has shown that configural and metric invariance holds across time for this construct, even with DCCS included in the fall only.

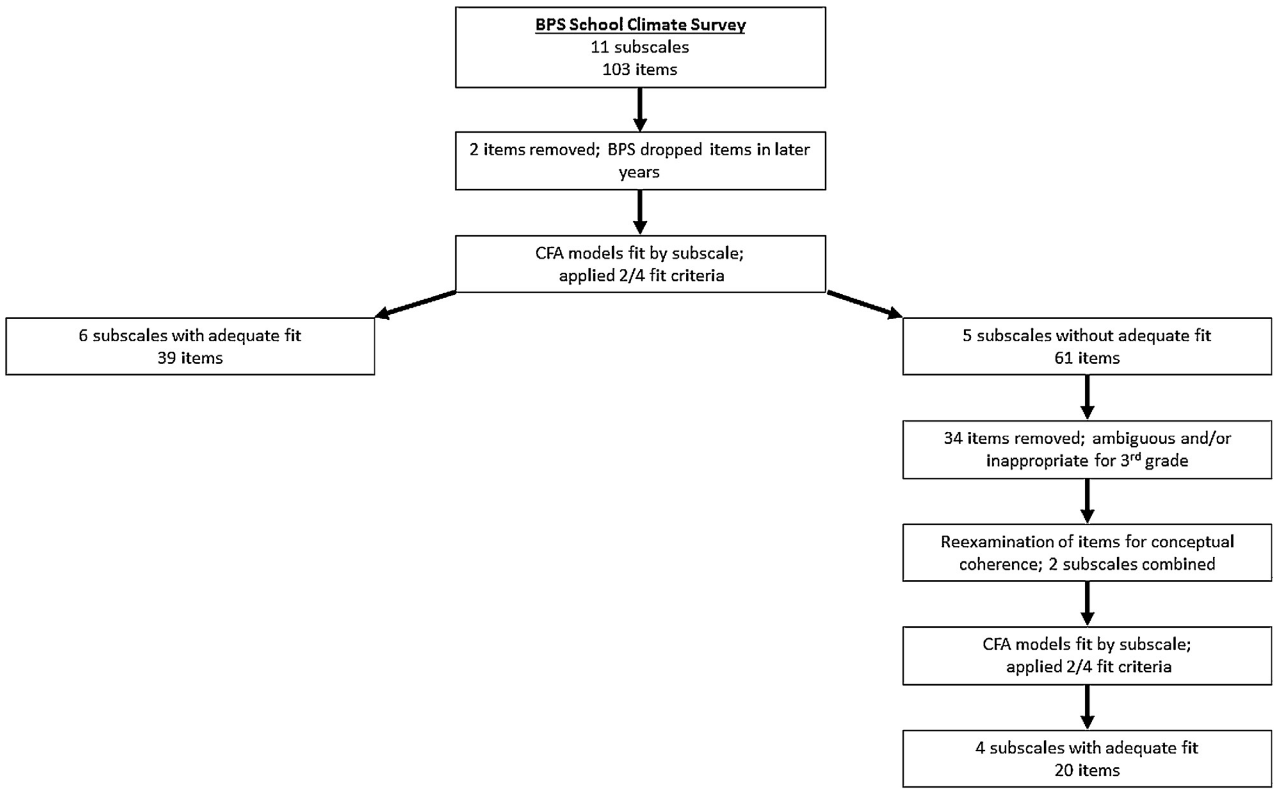

Fig. 2. Decision process for identifying school climate dimensions.

ture pointed to as contributors to classroom quality and student learning. Specifically, we included covariates for the percent of low-income students, the percent of students with disabilities, the percent of students who were English language learners, and the percent of students who remained in the school from the 2008–2009 to the 2009–2010 academic year. We also included the average school achievement level by including the percent of third graders scoring at or proficient in math and English language arts. There is some evidence to suggest that academic characteristics in the older grades can influence the academic development of younger children in the school (e.g., Zhai et al., 2012). Finally, we included covariates for the type of school the children attended (i.e., prekindergarten to grade 5, prekindergarten to grade 8) using a dichotomous indicator set to one if the child attended an elementary school and zero if otherwise, the percent of teachers retained between the 2008–2009 and 2009–2010 academic years, and the average student/teacher ratio of the school.

2.3.6. School climate

Dimensions of school climate were all measured using district-wide school climate surveys (Boston Public Schools, 2008–2017). The teacher and student surveys included a total of 94 items, organized by the district into 11 subscales. For the teacher survey, there were six BPS-identified school climate dimensions (52 items): work collegiality, school leadership, parent and student engagement, perceptions of collective efficacy, teacher self-efficacy, and teacher influence. For the student survey, there were five BPS-identified school climate dimensions (42 items): teacher effectiveness, principal effectiveness, school safety, perceptions of school, and enthusiasm for learning. These subscales are consistent with school climate surveys used by other large, urban school districts that have found relationships between school-level climate and school quality (e.g., lower teacher turnover; Kraft et al., 2016; larger percent of on-track students and higher test scores; Nathanson et al., 2013).

For each school climate dimension, we used aggregated school-level data from all students and teachers in the school. We made this decision because evidence suggests that teachers' and students' perceptions of school climate are sensitive to different aspects of the learning environment, which could be related to how their perceptions are measured (Thapa et al., 2013). While measures for teachers and students often include different sets of questions in our dataset, raters are not reporting on disparate topics as the constructs across raters fit within the essential supports framework. Including multiple reporters—the recommended approach in the school climate literature—could accurately capture the full range of school climate dimensions that likely influence children's learning and better support alignment between district-wide measures used in practice and established school climate frameworks, like the Essential Supports. The goal of our analyses was to combine complementary perspectives to gain a more global understanding of the experiences of teachers and students who are embedded within schools.

Most items ($N = 81$ out of 103 items) had the same four-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree) that asked respondents to rate agreement with each statement. Some items ($N = 12$ out of 103 items) had a four-point Likert scale that asked respondents to indicate how often s/he observed or experienced certain events (1 = never, 2 = sometimes, 3 = most times, 4 = always), or asked teachers to express how much control or influence s/he has over students and classroom (1 = none/nothing, 2 = very little, 3 = quite a bit, 4 = a great deal ($N = 10$ out of 103 items). All items and dimension were scored on the same continuum where higher scores demonstrate a more positive climate.

As explained in our literature review, school climate has no agreed-upon definition or measurement approach in the field. To create our constructs, we adopted a theory- and data-driven approach for identifying the school climate dimensions as shown

Table 4
Descriptive statistics and bivariate correlations for the school climate dimensions.

School climate dimension	α	Mean (*SD*)	Range	1	2	3	4	5	6	7	8	9	10
1. Pos emotional climate	0.86	3.11 (0.14)	2.75–3.38	–									
2. Enthusiasm for learning	0.94	3.54 (0.09)	3.35–3.81	0.27*	–								
3. Teacher effectiveness	0.93	3.46 (0.11)	3.20–3.64	0.36**	0.78***	–							
4. Instructional leadership	0.97	1.61 (0.19)	0.99–1.90	0.33*	0.19	0.10	–						
5. Teacher influence	0.90	2.71 (0.29)	2.05–3.31	0.28*	−0.18	−0.31*	0.54***	–					
6. Principal effectiveness	0.96	3.50 (0.17)	3.01–3.78	0.14	0.59***	0.32*	0.40**	0.06	–				
7. Work collegiality	0.95	3.12 (0.30)	2.28–3.70	0.29*	0.05	0.16	0.36**	0.33**	−0.11	–			
8. Teacher self-efficacy	0.86	3.34 (0.19)	2.50–3.68	0.17	0.05	0.13	0.18	0.34**	0.12	0.15	–		
9. Collective efficacy	0.93	3.25 (0.20)	2.72–3.71	0.44**	0.16	0.18	0.39**	0.39**	0.01	0.88***	0.20	–	
10. P and S engagement	0.93	2.71 (0.25)	2.07–3.32	0.32*	0.08	0.02	0.17	0.32*	0.14	0.20	0.34**	0.44**	–

Note. Pos emotional climate = positive emotional climate; Collective efficacy = perceptions of collective efficacy; P and S engagement = Parent and student engagement.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

in Fig. 2. First, we screened out items the district included inconsistently across the five years of survey administration (2009–2010 through 2015–2016), dropping two items (one each from teacher and student surveys). We then fit confirmatory factor analyses (CFA) models of the factor structures of the 11 BPS-identified dimensions of school climate, including student and teacher reports together in the models. Fit indices were compared to the recommended thresholds of CFI and TLI values of at least 0.90, RMSEA below 0.05, and SRMR below 0.10 (Browne & Cudeck, 1993; Hu & Bentler, 1999). Models meeting at least two of the four indices were considered to have adequate fit to the data (particularly as evidence suggests that some fit indices, such as RMSEA, do not perform well in small samples; Little, Card, Slegers, & Ledford, 2007).

Indices suggested that the hypothesized model adequately fit the data for the following six of 11 school climate dimensions reported by BPS: work collegiality [CFI = 0.93; TLI = 0.88; RMSEA = 0.25; SRMR = 0.03], teacher self-efficacy [CFI = 1.00; TLI = 0.99; RMSEA = 0.06; SRMR = 0.01], teacher influence [CFI = 1.00; TLI = 0.99; RMSEA = 0.07; SRMR = 0.01], teacher effectiveness [CFI = 0.91; TLI = 0.90; RMSEA = 0.15; SRMR = 0.05], principal effectiveness [CFI = 0.99; TLI = 0.96; RMSEA = 0.17; SRMR = 0.02], and enthusiasm for learning [CFI = 0.92; TLI = 0.89; RMSEA = 0.18; SRMR = 0.04]. Three dimensions were from the teacher survey (work collegiality, teacher self-efficacy, teacher influence) and three from the student survey (teacher effectiveness, principal effectiveness, enthusiasm for learning). We maintained these dimensions for the current study because they contained significant overlap with the Essential Supports framework and because of their relevance to BPS's conceptualization and use of school climate data. For example, the teacher influence dimension identified by BPS maps onto the teacher influence measure within the framework's school leadership area. Similarly, the BPS-identified dimension termed perceptions of collective efficacy is well aligned with Essential Supports' collective responsibility measure within the professional capacity support.

The remaining five dimensions did not have adequate fit and we accordingly examined the individual items within each dimension for construct validity. We first removed items ($N = 12$) that we deemed inappropriate for third graders, the youngest grade of reporters (e.g., for the item, "I brag about my school to friends who do not attend this school", it was unclear which aspects of their schooling environment children were judging when determining whether to brag about their school). Next, we dropped items ($N = 22$) that did not cleanly fit on any one dimension (e.g., "Your students come to school ready to learn". Here, teachers' perceptions about whether their students are ready to learn could be influenced by children's day-to-day experiences, such as completing homework when assigned, or their views about/collegiality with their students' previous-grade teacher). The screening process resulted in a total of 34 items being dropped.

We then examined the remaining items ($N = 27$) and subscales for conceptual coherence using recent school climate research (e.g., Cohen et al., 2009; Thapa et al., 2013) and the Essential Supports framework (Bryk et al., 2010), which led to combining the original BPS dimensions of school safety and perceptions of school to create a new dimension of positive emotional climate. School leadership was renamed instructional leadership to more accurately reflect the items. Finally, we refit the CFAs with the remaining items and subscales, applying the same adequate fit criteria. The iterative process resulted in four school climate dimensions: parent and student engagement [CFI = 0.96; TLI = 0.92; RMSEA = 0.25; SRMR = 0.02], instructional leadership [CFI = 0.97; TLI = 0.94; RMSEA = 0.24; SRMR = 0.01], perceptions of collective efficacy [CFI = 0.99; TLI = 0.99; RMSEA = 0.07; SRMR = 0.01], and positive emotional climate [CFI = 0.98; TLI = 0.93; RMSEA = 0.13; SRMR = 0.04]. A complete list of school climate dimensions and items can be found in Supplementary Appendices A and B.

As shown in the last column of Table 1, our analyses resulted in 10 dimensions of school climate, six dimensions originally identified by BPS and four researcher-constructed dimensions based on the Bryk et al. (2010) framework. We calculated a score for each dimension by taking a unit-weighted average of the items for that dimension. Cronbach's alpha for each dimension ranged from 0.86 to 0.97 (see Table 4). The final 10 school climate dimensions used as predictors of observed prekindergarten classroom quality and children's receptive vocabulary and EF skills across the prekindergarten year include the following: work collegiality, instructional leadership, parent and student engagement, perceptions of collective efficacy, teacher self-efficacy, teacher influence, teacher effectiveness, principal effectiveness, positive emotional climate, and enthusiasm for learning. See Supplementary Appendix C for a detailed description of each school climate dimension.

2.4. Data analytic approach

To address the first research question – whether higher school climate scores as reported by teachers and older children (grades 3–8) were associated with higher observed prekindergarten classroom quality – we fit a series of hierarchical multilevel regression models with random intercepts for schools. We first regressed classroom quality on each dimension of school climate. We then added our other covariates to the model in turn in conceptual blocks (i.e., first, classroom-level covariates; second, teacher experience

Table 5
Associations between school climate and classroom quality.

	Aspect of classroom quality											
	Emotional support				Classroom organization				Instructional support			
Predictor	M1	M2	M3	M4	M1	M2	M3	M4	M1	M2	M3	M4
School climate dimension												
Positive emotional climate	2.14** (0.63)	2.06** (0.76)	1.75* (0.76)	2.32** (0.89)	1.64* (0.77)	1.59* (0.79)	1.45 (0.97)	2.12~ (1.08)	1.61~ (0.92)	1.35 (1.18)	0.92 (1.32)	0.93 (1.51)
Teacher effectiveness	1.59~ (0.84)	1.40~ (0.83)	1.79* (0.85)	2.29* (0.96)	1.86~ (0.97)	1.66* (0.84)	2.16* (1.02)	2.88* (1.16)	1.01 (1.18)	0.76 (1.24)	1.25 (1.40)	2.29 (1.58)
Enthusiasm for learning	1.39 (1.08)	0.97 (0.99)	1.01 (1.08)	1.65 (1.40)	1.02 (1.24)	0.63 (1.08)	0.87 (1.34)	1.97 (1.77)	0.46 (1.45)	−0.15 (1.48)	0.25 (1.68)	1.88 (2.12)
Instructional leadership	0.03 (0.57)	0.08 (0.53)	0.17 (0.55)	−0.20 (0.63)	−0.18 (0.63)	0.03 (0.57)	0.04 (0.69)	−0.47 (0.80)	−0.86 (0.73)	−1.12 (0.76)	−1.03 (0.84)	−1.98* (0.87)
Teacher influence	−0.04 (0.36)	−0.25 (0.36)	−0.36 (0.39)	−0.50 (0.43)	−0.20 (0.40)	−0.27 (0.38)	−0.44 (0.48)	−0.72 (0.55)	−0.32 (0.46)	−0.57 (0.52)	−0.73 (0.59)	−1.19~ (0.62)
Principal effectiveness	0.16 (0.55)	0.26 (0.51)	−0.02 (0.55)	−0.48 (0.86)	−0.27 (0.63)	−0.15 (0.55)	−0.24 (0.69)	−0.20 (1.05)	−0.76 (0.71)	−1.10 (0.74)	−1.15 (0.84)	−1.98 (1.24)
Work environment collegiality	0.17 (0.32)	−0.25 (0.33)	−0.25 (0.35)	−0.27 (0.44)	0.28 (0.37)	−0.12 (0.36)	−0.05 (0.44)	−0.18 (0.55)	0.10 (0.42)	−0.62 (0.49)	−0.50 (0.54)	−0.88 (0.66)
Teacher self-efficacy	0.96 (0.58)	0.61 (0.58)	−0.13 (0.72)	−0.10 (0.77)	0.65 (0.64)	0.33 (0.60)	−0.15 (0.79)	−0.08 (0.82)	0.12 (0.78)	−0.39 (0.85)	−0.90 (1.03)	−0.83 (1.07)
Perceptions of collective efficacy	0.32 (0.48)	−0.70 (0.55)	−0.80 (0.56)	−1.14 (0.73)	0.17 (0.55)	−0.77 (0.58)	−0.79 (0.70)	−1.50~ (0.89)	0.31 (0.63)	−1.08 (0.80)	−0.97 (0.87)	−1.46 (1.08)
Parent and student engagement	0.98* (0.39)	0.20 (0.51)	0.25 (0.51)	0.08 (0.73)	0.92* (0.44)	0.41 (0.52)	0.46 (0.58)	0.35 (0.79)	0.77 (0.54)	−0.01 (0.74)	−0.12 (0.78)	−0.15 (1.04)
Classroom sociodemographic characteristics		X	X	X		X	X	X		X	X	X
Teacher experience and classroom quality			X	X			X	X			X	X
School characteristics				X				X				X

Note. Classroom models control for classroom sociodemographic characteristics (gender, mobility, free-reduced-lunch eligibility, special needs status, race/ethnicity, home language, and attendance zone), teacher background (years of experience, teacher education), and school characteristics (student/teacher ratio, percent of students who remained in the school/district from the 2008–2009 to 2009–2010 academic year, percent of low income students, percent of students with disabilities, percent of teachers retained, percent of third-graders at or proficient on standardized English language arts exam, the percent of third-graders at or proficient on standardized math exam, and whether the school was PK – 5). The "X"s represents the group of variables that was introduced to model in conceptual blocks. This table shows results from 30 different series of random effects multilevel regression models with random effects for schools, where CLASS emotional support, CLASS classroom organization and CLASS instructional support were regressed onto each separate school climate dimension. Robust standard errors in parentheses.

~ $p < 0.10$.
* $p < 0.05$.
** $p < 0.01$.

and education; and finally, school-level covariates). We examined the stability of point estimates and standard errors for the key question predictors – dimensions of school climate – across this set of four models per outcome.

We followed the same conceptual block model-building procedure in examining the second research question – whether school climate was associated with gains in receptive vocabulary and EF – and fit a series of hierarchical multilevel regression models with random intercepts for schools. In our first conceptual block, however, we regressed end-of-year receptive vocabulary and EF on each dimension of school climate and the associated beginning-of-year child outcome. We then added our covariates in conceptual blocks (i.e., first, child-level sociodemographic characteristics; second, teacher experience and classroom quality; and finally, school-level covariates).

There was a small amount of missing data at the child and classroom level, ranging from 2% to 10% (see the notes in Tables 2 and 3 for more details). We used multiple imputation (50 datasets) to account for missing child-level pretest and classroom-level data with all analytical variables used in the imputation model (Graham, 2009). Findings were stable across models that used imputed and non-imputed data (see Supplementary Appendix D). All regression analyses were conducted in Stata 13.

3. Results

3.1. Descriptive statistics: School climate predictors

We first calculated descriptive statistics on the school-level climate dimensions. On average, children were in schools that had a positive climate. For example, teachers were rated to have high rates of effectiveness (*M* = 3.46; *SD* = 0.11; Range = 3.20–3.64) and students reported themselves as being engaged in their own learning (*M* = 3.54; *SD* = 0.09; Range = 3.35–3.81). However, schools had relatively low instructional leadership (*M* = 1.61; *SD* = 0.19; Range = 0.99–1.90), indicating that on average, teachers felt that principals had low expectations for and involvement in teaching and learning. As shown in Table 4, correlations between dimensions of school climate ranged from 0.29 to 0.88. When we examined the correlations in light of the Essential Supports framework, we found some statistically significant correlations among school climate dimensions within the same overall support area. For example, the following three school climate dimensions addressed the student-centered learning climate support: positive emotional climate, teacher effectiveness, and student enthusiasm for learning. We found generally moderate to strong statistically significant correlations among these climate dimensions (range of 0.27–0.78).

Table 6
Associations between school climate and prekindergarten gains.

Predictor	Prekindergarten outcome							
	Receptive vocabulary				Executive function			
	M1	M2	M3	M4	M1	M2	M3	M4
School climate dimension								
Positive emotional climate	4.69 (7.31)	−3.76 (7.73)	−0.86 (8.90)	−1.76 (12.01)	−0.01 (0.07)	−0.06 (0.07)	−0.06 (0.08)	−0.16 (0.11)
Teacher effectiveness	3.51 (9.21)	3.71 (9.08)	12.65 (10.01)	6.04 (11.77)	0.11 (0.09)	0.12 (0.09)	0.09 (0.10)	0.03 (0.11)
Enthusiasm for learning	8.37 (11.46)	9.77 (11.14)	19.12 (12.39)	7.32 (15.12)	0.12 (0.11)	0.13 (0.11)	0.11 (0.12)	0.01 (0.14)
Instructional leadership	1.15 (5.51)	−0.56 (5.49)	−0.08 (6.00)	−3.92 (7.13)	0.00 (0.05)	0.01 (0.05)	−0.00 (0.06)	−0.05 (0.07)
Teacher influence	0.40 (3.48)	−1.07 (3.57)	−2.19 (3.78)	−0.54 (4.21)	−0.04 (0.03)	−0.05 (0.03)	−0.05 (0.04)	−0.05 (0.04)
Principal effectiveness	1.88 (5.19)	4.36 (5.18)	4.87 (5.92)	−2.50 (8.28)	0.01 (0.05)	0.05 (0.05)	0.05 (0.06)	0.01 (0.08)
Work environment collegiality	2.79 (3.34)	−0.77 (3.43)	−0.95 (3.62)	−0.62 (4.47)	0.04 (0.03)	0.01 (0.03)	−0.01 (0.03)	−0.01 (0.05)
Teacher self-efficacy	5.56 (6.68)	4.17 (6.65)	1.81 (8.01)	2.22 (8.14)	−0.00 (0.07)	0.01 (0.07)	0.02 (0.08)	0.03 (0.08)
Perceptions of collective efficacy	7.08 (5.00)	−0.76 (5.54)	−1.77 (5.78)	−0.90 (7.85)	0.05 (0.05)	−0.03 (0.05)	−0.04 (0.06)	−0.07 (0.08)
Parent and student engagement	5.38 (4.16)	−0.18 (4.45)	0.96 (4.93)	4.15 (7.06)	0.05 (0.04)	0.02 (0.04)	0.02 (0.05)	0.04 (0.07)
Child sociodemographic characteristics		X	X	X		X	X	X
Teacher experience and classroom quality			X	X			X	X
School characteristics				X				X

Note. Student models control for child sociodemographic characteristics (gender, mobility, free-reduced-lunch eligibility, special needs status, race/ethnicity, home language, and attendance zone), teacher experience and classroom quality (years of experience, teacher education, emotional support, classroom organization, instructional support), and school characteristics (student/teacher ratio, percent of students who remained in the school/district from the 2008–2009 to 2009–2010 academic year, percent of low income students, percent of students with disabilities, percent of teachers retained, percent of third-graders at or proficient on standardized English language arts exam, the percent of third-graders at or proficient on standardized math exam, and whether the school was PK-5). The "X"s represents the group of variables that was introduced to model in conceptual blocks. This table shows results from 20 different random effects hierarchical regression models with random effects for schools, where receptive vocabulary and executive function were regressed onto each separate school climate dimension. Robust standard errors in parentheses.

Before fitting our regression models, we calculated the proportion of total outcome variation that lies "between" schools, also called the school-level intraclass correlation (ICC) for our classroom quality and prekindergarten vocabulary and EF outcomes (Singer & Willett, 2003). The ICCs for the domains of classroom quality in null models were 0.17, 0.19, and 0.31 for emotional support, classroom organization, and instructional support, respectively. The school-level ICCs in null models for receptive vocabulary and EF were 0.02 and 0.10, respectively. All ICCs suggest that the majority of the outcome variation lies within schools, rather than between them.

3.2. Regression analyses

For research question one – the relationship between school climate and observed classroom quality in prekindergarten – we found statistically significant associations between two dimensions of school climate and classroom quality. Table 5 displays these results by classroom quality dimension. In each classroom quality panel, Model 1 shows results of including only the school climate indicator of interest. Model 2 included both the school climate dimension and classroom sociodemographic characteristics. Model 3 included the variables from Model 2 and teacher experience and quality. Model 4 included the variables in Model 3 and school characteristics.

We focus on interpreting results from the full model given that it likely best controls for potential school/classroom-level endogeneity and because of the relative stability of point estimates and standard errors across all four conceptual blocks. As shown in column 5 of Table 5, having a positive emotional school climate was statistically significant and positively predictive of prekindergarten classroom emotional support ($\beta = 2.32$, $p = 0.009$), controlling for teacher, classroom, and school characteristics. Using parameter estimates from Model 4, this association translated into moderate standardized coefficient of 0.47, using Cohen's *d* (e.g., multiplying the predictor's coefficient by the standard deviation of the predictor and dividing by the standard deviation of the outcome; NICHD ECCRN & Duncan, 2003). We also found that teacher effectiveness was a statistically significant, positive predictor of emotional support ($\beta = 2.29$, $p = 0.017$) and classroom organizational support ($\beta = 2.88$, $p = 0.013$) controlling for teacher, classroom, and school characteristics (see columns 5 and 9 of Table 5). These associations translated to moderate standardized coefficients of 0.37 and 0.45, respectively. No other school climate models were predictive of observed prekindergarten classroom quality across all four models.

For research question two, we followed the same model-building strategy. We found no evidence of an association between school climate and children's gains in receptive vocabulary (see columns 2–5, Table 6) or in children's EF skills (see columns 6–9, Table 6). There was no consistency in the direction of associations; for example, for receptive vocabulary across the most controlled model (M4), four associations were positive in direction and six were negative.

Finally, to ensure that our null findings for EF were not due to our decision to form a composite EF score (provided past work on differential effects of classroom processes on EF by specific EF component [Hamre et al.,2014]), we refit our primary models with each of the EF tasks as outcomes. In addition, to ensure that our null findings were unrelated to time between fall and spring testing, we also refit our child-level models controlling for days between testing dates. Our results were not sensitive to these analytic decisions (see Supplementary Appendix F).

4. Discussion

Our findings extend the current literature by examining the role of school climate during prekindergarten, a developmental period few previous studies in this literature have considered. We used current domains of school climate as described in the research literature (Berkowitz et al., 2017; Thapa et al., 2013) and the Essential Supports framework, a comprehensive and empirically-tested model of school supports in elementary school settings (Bryk et al., 2010), to establish the reliability and validity of a district-wide teacher and student survey. At the classroom level, we found associations between classroom emotional support and two dimensions of school climate, positive emotional climate and teacher effectiveness. We also found an association between classroom organization and teacher effectiveness. These associations were robust across model specifications and were small to moderate in magnitude (Cohen's d = 0.35–0.55). School climate was not related to prekindergarten children's receptive vocabulary and EF gains.

Our classroom-level findings suggest that prekindergarten classrooms in schools that older children consider safe and academically supportive tend to have teachers who maintain positive relationships with their students and teachers that can successfully manage day-to-day classroom tasks (e.g., behavior management, instructional learning formats). Notably, both of these school climate dimensions fit within the student-centered learning climate essential in the Essential Supports framework (Bryk et al., 2010). While these findings are promising for the use of school climate measures, the drivers behind these relations are unclear. It could be that prekindergarten teachers have more teaching time due to fewer disruptions to school and classroom routines in schools where older students feel safe and perceive as orderly. Or perhaps more emotionally supportive prekindergarten classrooms are indicative of the overall support that schools provide, which is consistent with older students' perception that school teachers create a supportive academic environment. In other words, prekindergarten teachers may be embodying the schools' positive approach to learning in their interactions with the children in their classroom. Because our investigation is correlational, it could also be that a more positive emotional climate is reflective of classrooms that are more emotionally supportive. Or perhaps stronger prekindergarten teachers select into schools with more supportive climates.

It is important to note that for 8 out of 10 school climate dimensions, we found no relation between broader school climate and classroom quality across our four conceptual blocks. Our mix of statistically significant associations and null findings between some measures of school climate and classroom quality findings fit with the extant literature, in which findings have been mixed as well. While relational and organizational climate had small associations with global measures of classroom quality (Dennis & O'Connor, 2013), these relational school climate dimensions were not predictive of specific domains of classroom quality like emotional support (Zinsser & Curby, 2014). Perhaps more proximal school climate characteristics that influence children's day-to-day interactions, like teacher support and students' physical and emotional safety, are more important for specific aspects of the prekindergarten classroom environment.

At the child level, we did not find evidence to support a link between school climate and children's gains in receptive vocabulary and EF. These findings were somewhat surprising given that several studies have found that school-level adult support is predictive of older children's academic outcomes (e.g., Hopson & Lee, 2011; Lucio, Hunt, & Bornovalova, 2012; Stewart, 2008). Also, from a theoretical perspective, a more positive school climate could have increased teachers' expectations for students, leading to higher-level instruction including use of more sophisticated vocabulary. For EF, school climate might have been expected to influence children's EF gains as prekindergarten children attending schools with more positive climates might have had more structure and routine in their schooling environment, which may have created more opportunity for children to effectively practice working memory and be supported along the way.

Drawing on theories of bioecological systems that posit children are nested within multiple contexts (Bronfenbrenner, 1977; Bronfenbrenner, & Morris, 1998), it could be that prekindergarten teachers serve as a buffer to the broader schooling context, such that children's daily classroom experiences (e.g., teacher–child and peer-to-peer interactions) are more salient to the development of their foundational vocabulary and self-regulatory skills than school-wide occurrences. Another explanation for our null associations with children's cognitive gains could be that prekindergarten children spend less time outside of their classrooms than older children and therefore are less likely to be directly affected by their school's broader climate. We are not aware of studies that identify how prekindergarten children in public schools spend their time versus children in the older grades in their same school. Providing such evidence in future studies would help to further unpack how broader school climate may influence prekindergarten children's learning and development.

Notably also, the prior literature on older children did not examine vocabulary or executive function. It could be the case that school climate affects other child outcomes in prekindergarten, just not the ones measured in our study. For example, children's behavior can be particularly contextually dependent; more positive school climate could be associated with reductions in children's problem behaviors across the prekindergarten year. Also regarding measurement, we view it as unlikely that our null findings for EF are due to our choice of EF tasks given past work on how classroom processes predict children's gains on the Pencil Tap (Williford, Whittaker, Vitiello, & Downer, 2013) and BDS (Hamre et al., 2014) EF tasks in prekindergarten and given the comparatively good performance of our tasks versus others in a recent prekindergarten study (Lipsey et al., 2017).

There are a number of limitations to this study. First, we were unable to identify the grade of student and teacher raters within our school climate data. As a result, it is unclear if there are differences (or similarities) in school climate perceptions between older and younger elementary teachers and students. Due to our sample size, we were unable to examine measurement invariance across teachers and students. Future research should also collect rater demographic data (e.g., grade, age) and examine the potential influence of additional school-level characteristics on perceived school climate. Second, there was not much variation in climate dimension scores across the district surveys at the school-level (e.g., enthusiasm for learning M = 3.54, SD = 0.09), which limited our ability to use them as predictors of classroom quality and children's academic outcomes and to use multilevel measurement models to operationalize constructs. Future studies should employ multilevel measurement models and explore whether classroom quality mediates the relationship between school climate and prekindergarten children's academic outcomes. Third, our investigation included one school district in which all prekindergarten programs were within urban public schools which limits the external validity of our findings.

Fourth, we fit 60 regression models in our analyses (four models for each school climate predictor across five outcomes) that included a relatively small sample of prekindergarten children, which could have led to some null and spurious results. Given the exploratory nature of our study and consistent with current guidelines (Schochet, 2009), we did not adjust for multiple comparisons. We emphasized results that were stable across models for a given predictor and outcome (four total) to help limit attention to spurious results. Fifth, our exploratory study is correlational and not causal in nature. Sixth, we lacked data on how integrated prekindergarten classrooms in our sample were in the broader school (e.g., close to K and above classrooms, versus in the basement or in an annex). Such data would be useful in future studies in understanding how the broader school climate does or does not affect prekindergarten classrooms processes. Also, we do not consider the relationship between school climate and home factors (e.g., home emotional climate). For example, it is unclear whether school climate matters most for children for whom there is a bigger contrast with their home climate. Future studies should consider the influence of school climate dimensions on other child outcomes that may be particularly relevant for the prekindergarten period, such as the aforementioned home factors and children's social–emotional skills.

Finally, the school climate measures used in our study do not explicitly take the full prekindergarten context into account. For example, many prekindergarten programs place a large emphasis within programmatic activities to support parents (e.g., supporting parents in the transition to kindergarten), which is not often reflected in existing school climate measures. Research has only recently begun to consider the role that school climate may have on early childhood settings. Drawing from the Essential Supports framework (Bryk et al., 2010), a team of scholars from the University of Chicago has started to examine how climate-like characteristics of school- and center-based programs (e.g., socio-emotional instruction, teacher outreach and collaboration with parents) as reported by teachers and parents may support program-level quality and instructional quality in prekindergarten classrooms (Ehrlich et al., 2016; Ehrlich, Pacchiano, Stein, Wagner, 2018; Ehrlich, Pacchiano, Stein, Wagner, Park et al., 2018). Ehrlich, Pacchiano, Stein, & Wagner (2018) and Ehrlich, Pacchiano, Stein, Wagner, Park et al. (2018) found some evidence – like the findings from the current study – that prekindergarten programs with more supportive environments (e.g., positive learning climate, teacher safety) were related to site-level characteristics, such as increased student attendance. As measures become available, districts serving younger children should also consider integrating climate-like measures into their existing survey efforts. Future work should also continue to explore the role of school and organizational climate in early childhood settings on a broader range of site-level characteristics (e.g., teacher turnover).

Despite these limitations, our study contributes to the current policy and practice discussion nationally and internationally regarding the use of school climate measures in school improvement and accountability efforts. Our classroom-level findings suggest that school climate may have implications for the quality of prekindergarten students' experiences and that prekindergarten should not be left out of ESSA school climate discussions. If our findings replicate in other settings, local districts should, for example, consider taking school climate into account if they have choice in how to expand their prekindergarten programs. Keeping prekindergarten children in mind when making school improvement decisions may ensure that the school's youngest learners benefit from a broader positive and supportive learning environment.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.ecresq.2019.02.008.

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