The Relation between School Climate and Student Outcomes

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The Relation between School Climate and Student Outcomes

Abstract

Using multiple years of student survey data from a large, urban school district, this study employed factor analysis to identify disparate, measurable aspects of school climate, which were then examined individually using probit models to determine the extent to which each is associated with the overall effect of a school on student academic outcomes. Differences among grade level, gender and racial/ethnic groups were also studied. Reliable, intuitive aspects of school climate can be identified from the data. These factors, to varying extents, can partially explain students' performance at a given school on our two measures of educational attainment.

Introduction

The field of education research is based on the belief that a student's experiences at school significantly affect their ultimate academic outcomes and, furthermore, that these experiences can be controlled to some extent through school policies, procedures and practices. The function of education research, then, is to identify specific aspects of the overall experience that matter in terms of student outcomes and determine the policies, procedures and practices that lead to the best student outcomes.

A multitude of factors beyond curriculum and instruction can affect a student's academic trajectory. Individual factors and family dynamics certainly play a role, as do the socio-political and cultural norms of the larger society. But school-level factors, often collectively referred to as school climate or school culture, also affect a student's educational experience in both obvious and subtle ways. However, the construct of school climate is broad and, as yet, loosely defined in the research literature.

This study aims to address this issue by identifying disparate, measurable aspects of school climate and determining the extent to which each of them is associated with the overall effect of the school—the cumulative experiences on the students who attended during a range of school years—on the academic outcomes of their students. An important goal of the analysis is to disaggregate students by racial/ethnic group to test both for differences in perceptions across student groups and for different associations between groups' perceptions of school climate and their later academic outcomes. The study is conducted in the second largest school district in California, the San Diego Unified School District, using the California Healthy Kids Survey (CHKS). CHKS is the largest statewide student survey of resiliency, protective factors, risk behaviors, and school climate in the nation. We find meaningful associations between student

perceptions of school climate and students' later academic performance. We also find some variations by race and ethnicity.

Literature Review and Conceptual Framework

School Climate Research Challenges

School climate has increasingly become a topic of education research as evidence supporting the relationship between school climate and student outcomes continues to grow (Thapa, Cohen, Guffey & Higgins-D'Alessandro, 2013). In 2014, the Federal government increased the focus by releasing *Guiding Principles: A Resource Guide for Improving School Climate and Discipline*, in which the US Department of Education gave recommendations for increasing student achievement through improving school climate. However, despite the attention -- Dulay & Karada included well over 200 studies in their 2017 meta-analysis of school climate research -- school climate remains a loosely defined construct. It has been used as an umbrella term to unite myriad aspects of a school's campus or student body, from the physical structures to the pedagogical philosophy to student attitudes and behaviors, from varied perspectives including student, teacher, administrator and parent, and as a measure of both individual and collective school experiences. In the following sections we discuss each source of variability and present the rationale for our approach in this study.

Conceptual Framework

In many ways, school climate is analogous to the climate of a geographical region. Both are multidimensional constructs that aim to describe the environment in which people operate. However, while there is an agreed-upon set of measures that make up geographical climate (i.e., temperature, humidity, atmospheric pressure, wind, rainfall), consensus has not yet been reached among researchers as to what factors should be included in the definition of school climate.

In their 2013 review of school climate research, Thapa et al. delineate five dimensions of school climate: Safety, Relationships, Teaching and Learning, Institutional Environment and the School Improvement Process. Jain, Huang, Hanson & Austin (2015) define school culture even more broadly as "the physical and social conditions of the learning environment." Wang & Degol (2016) present a model that divides 13 specific aspects of school climate into four larger categories of safety, community, academic and institutional environment, while Ramsey, Spira & Parisi (2016) distill the research into five common themes of order, safety and discipline; academic outcomes; social relationships; school facilities; and school connectedness. Aldredge, Fraser, Fozdar, Ala'i, Earnest & Afari (2016) measured six areas of school climate: teacher support, peer connectedness, school connectedness, affirming diversity, rule clarity and reporting and seeking help, while Konishi, Miyazaki, Hymel & Waterhouse (2017) label their school climate domains "peer support, discipline/fairness/clarity of rules, and school safety." Some studies even include things that occur at home or in the community as aspects of school climate (Gage, Larson, Sugai & Chafouleas, 2016). Not surprisingly, these conceptual variations translate to a broad range of disparate measures, all intending to assess "school climate," but operationalizing the construct in different ways.

In spite of a long history of variability in the construct's definition, recent attention by educational policy-makers has led to widescale efforts to assess school climate, which has been met by the development of commonly used instruments, and, largely based on the content of these instruments, several commonly accepted factors have begun to emerge. The National Center on Safe and Supportive Learning Environments (NCSSLE) *School Climate Compendium* (https://safesupportivelearning.ed.gov/edscls/measures) lists 30 such instruments that it deems both valid and reliable, including the California Healthy Kids Survey (CHKS), and has focused

on three broad categories of school climate factors: student engagement, safety and environment. Student engagement includes relationships with teachers, participation or involvement with school, and a general feeling of connectedness to school. The safety category includes both physical and socio-emotional safety, measures of bullying and violence, as well as the self-reported sense of safety on campus. Environment factors include the physical school campus, the academic culture, discipline policies and experiences, and the physical and mental health of students. All these factors are addressed in the CHKS, the instrument used in the present study.

Differing Perspectives

Most school climate research uses surveys; however, not only the survey items but also the role of the targeted respondents can differ from study to study. Prior to the late 1970s, school climate measures focused overwhelmingly on teacher perception (Anderson, 1982). In recent decades, the trend has been to look at school climate more from the perspective of the student or from multiple perspectives, as recommended by Ramsey, Spira & Parisi (2016). The present study aims to study the student perspective and uses data from the student version of the CHKS.

The Role of Demographics

A handful of studies has looked differences by student group in perceptions of school climate (Way, Reddy & Rhodes, 2007; Voight, Hanson, O'Malley & Adekanye, 2015). Shirley & Cornell (2012) found that Black students reported more peer aggression than White students, as well as less willingness to seek help from teachers when bullied or threatened.

Demographic differences in the student body have also been shown to affect school climate variables. For instance, at schools that serve low income populations, Hispanic- and Black-majority schools, and/or low-performing schools, staff report less positive school climates

(Jain, Cohen, Huang, Hanson & Austin, 2015). Waters, Cross & Shaw (2010) also found lower ratings of student connectedness at schools with more poor students.

Level of Study – Individual vs. Collective

Most recent studies have used individual student data to look at the relationship between school climate and educational outcomes. That is, they focus on the relationship of an individual's perception of school climate to that individual's achievement, behavior, etc. (Berkowitz, Hadass, Moore, Astor & Benbenishty, 2016; Dulay & Karadağ, 2017). While this approach can tell us much about the relationship between an individual student's school experience and a variety of academic, social and behavioral outcomes, as a study of climate, this approach is potentially misleading because the notion of school climate is inherently a social construct, not a student-level variable (Bandyopadhyay, Cornell & Konold, 2009; Konold & Cornell, 2018.). That is, while perceptions of and experiences at school can vary widely from student to student, the concept of a "climate" implies collective perceptions and experiences. That is not to say that subcultures don't exist within the overall school climate. In fact, different groups of students within a school could have different views of the school's climate. The present study includes analyses of this possibility.

Predicting Outcomes

Much of the school climate literature has focused on behavioral rather than academic outcomes. School climate has been associated with student behavior (Cornell & Huang, 2016; Reaves, McMahon, Duffy & Ruiz, 2018), attendance (Van Eck, Johnson, Bettencourt & Johnson, 2017; Freeman, Simonsen, McCoach, Sugai, Lombardi & Horner, 2016), bullying and victimization (Waasdorp, Pas, O'Brennan & Bradshaw, 2011; Konishi et al., 2017; Benbenshty et al., 2016), delinquency and violence (Gottfredson, Gottfredson, Payne & Gottfredson, 2005;

Barnes, Brynard & de Wet, 2012; Welsh, 2000), and socioemotional wellbeing (Hoge, Smith & Hanson, 1990; Scott, Murray, Mertens & Dustin, 1996). Gage, Larson, Sugain & Chafouleas (2016) found that three factors—parent involvement, a caring adult at school and feeling safe at school—predict office discipline referrals. Jia, Konold & Cornell (2016) found that high academic expectations and supportive teachers are linked with lower dropout rates.

The lines between school climate and student outcomes can be blurry. For instance, Konishi et al. (2017) found that school climate variables predicted bullying, but bullying might also be seen as an aspect of school climate. Similarly, Cornell & Huang (2016) concluded that schools with an authoritative school climate had lower levels of student risk behaviors including alcohol and drug use, bullying, violence and suicidal thoughts and behavior. Again, these behaviors might be seen as aspects of school climate rather than outcomes.

Fewer studies look at academic outcomes. Daily, Mann, Kristjansson, Smith & Zullig (2019) found a relationship between school climate factors and students' self-reported grades, and Waters, Cross & Shaw (2010) found that schools with higher average writing skills had higher levels of connectedness. Konold, Cornell, Jia & Malone (2018) looked at high school graduation rates and school performance on state-level standardized tests and found associations between these academic outcomes and student engagement. Benbenishty, Avi Astor, Roziner & Wrabel (2016) found that increases in academic performance at the school level were associated with subsequent improvement in school belongingness, school adult support, and school participation, implying that school academic performance may influence school climate variables, rather than the reverse.

Research Questions

This study addresses three central questions:

1: What specific, disparate aspects of school climate can be identified using data from the core module of CHKS?

2: Are there differences in perceptions of school climate, or in the relations between school climate perceptions and academic outcomes, among different student groups?

3: Can these aspects of school climate help to explain the "value added" effect of a given school on academic outcomes?

Methodology

Measures

The California Healthy Kids Survey (CHKS) is a confidential and anonymous survey for students in grades 5, 7, 9 and 11. Developed by WestEd in 1997, it focuses on school climate and safety, student wellness, and youth resiliency. Between 2004 and 2010, the California Department of Education (CDE) required districts to administer the CHKS biennially at grades 7, 9 and 11 to be in compliance with Title IV of No Child Left Behind Act, and it remains a requirement for districts receiving certain government funds[1]. District-level reports are published on the CDE's CalSCHLS website, and school-level reports are also available upon request.

Sample

The San Diego Unified School District (SDUSD) administered the CHKS biennially to students in grades 7, 9 and 11 (until 2015) or annually (2016 and later) and has obtained (anonymous) student-level data files for SDUSD schools since 2011. Annual response rates ranged from 70% to 84%. (See appendix section A for more specific response rate data including disaggregation by grade level, gender, and race/ethnicity.)

[1] Specifically, biennial administration of the CHKS is required for schools that receive funding under the state Tobacco Use Prevention Education (TUPE) program and the Safe and Supportive Schools grant.

Analytical Approach

Data analysis for this project consisted of three distinct phases. The first phase included factor analysis of the CHKS data to identify domains within the construct of school climate that a) were defensible as separate factors for study, b) used questions that were posed consistently across all years of SDUSD CHKS files and c) had good face validity as important components of the overall climate and culture at a school. In the second phase we compared the actual performance of students from each middle and high school on specific academic outcomes to predictions based on each student's past academic performance and other characteristics. This analysis produced measures of school over- or under-performance. Third, we brought the results of these two together to determine whether the various components of school climate can help explain the variability among schools in the likelihood that students meet certain academic objectives. The methods used in each phase are detailed below.

Analysis Phase I – Factor Analysis of School Climate Data

In the CHKS Core Module (the basic set of questions required by the CDE), excluding basic demographic questions, 62 items were consistently asked between 2011 and 2017. Of these, 22 asked about student behaviors or attitudes outside of school (e.g., questions about alcohol or drug use off-campus) and were removed from the school climate factor analyses. (We did keep, however, questions about alcohol and drug use on campus.)

Exploratory factor analysis of the 40 remaining common items used the principal factor method of extraction, which uses the squared multiple correlation coefficients to estimate communality (the amount of variance shared among the items in the scale.) Two questions ("Do you consider yourself a member of a gang?" and "In the past year, how many times have you skipped school?") were found to lack sufficient communality (.18 and .22, respectively) and

were therefore dropped from the model. Lastly, a group of questions aimed at determining the perceived reason(s) for bullying ("During the past 12 months, how many times on school property were you bullied or harassed for any of the following reasons…") was collapsed into a single variable to reflect the frequency of bullying for *any* of the listed reasons. (In recent years the question, "During the past 12 months, how many times on school property were you bullied or harassed *for any reason*?" was added to the end of that question group.)

The resulting set of 33 variables showed good factorability. All but 2 items correlated at 0.3 or more with at least one other item and Bartlett's test of sphericity was significant ($p < .0001$), indicating sufficient correlation among the items. The Kaiser-Meyer-Olkin measure of sampling adequacy also indicated that the strength of the relationships among variables was high (KMO = .93).

Factor analysis with the principal factor method of extraction yielded four factors with eigenvalues greater than 1.0, and an additional two with values above .75. Given the strength of the intercorrelation measures, a second analysis was run using the principal component factor method of extraction, which estimates the inter-item commonalities as 1. This solution resulted in six factors with eigenvalues above 1.0. A scree plot seemed to justify either a 4- or a 6-factor solution, so both models were compared for ease of interpretation.

A non-orthogonal Promax rotation was selected to allow for inter-factor correlations and cross-loadings. The 4-factor solution resulted in several items with very similar cross-factor loadings. The rotated 6-factor solution, however, yielded no cross-factor loadings and the resulting item groups showed good face validity (i.e., were easily interpretable as distinct sub-elements of school climate,) and was therefore selected as the final factor model. The specific

items included in each factor are shown in Table 1. (Factor loadings for the final model can be found in appendix table B1.)

Table 1. School Climate Factors: Items, Covariance and Reliability Coefficients

Factor Name (Abbreviation)	Items Included
General feelings about your school (Feelings) *Mean Interitem Covariance = .52* *Cronbach's Alpha = .83*	How strongly do you agree or disagree with the following statements…? …I feel close to people at this school. …I am happy to be at this school. …I feel like I am part of this school. …The teachers at this school treat students fairly. …I feel safe in my school. How safe do you feel when you are at school?
Supportive adults at school (Adults) *Mean Interitem Covariance = .54* *Cronbach's Alpha = .90*	At my school, there is a teacher or some other adult… …who really cares about me. …who notices when I'm not there. …who listens to me when I have something to say. …who tells me when I do a good job. …who wants me to do my best. …who believes that I will be a success.
Sense of efficacy at school (Efficacy) *Mean Interitem Covariance = .53* *Cronbach's Alpha = .77*	At school… …I do interesting activities. …I help decide things like class activities or rules. …I do things that make a difference.
Alcohol or Drug use at school (School AOD) *Mean Interitem Covariance = .29* *Cronbach's Alpha = .90*	During the past 30 days, on how many days on school property did you… …smoke cigarettes? …have at least one drink of alcohol? …smoke marijuana? …use any other drug or substance to get "high?"
Experiences of bullying or victimization at school (Victim) *Mean Interitem Covariance = .40* *Cronbach's Alpha = .83*	During the past 12 months, how many times on school property have you… …had mean rumors or lies spread about you? …had sexual jokes, comments, or gestures made to you? …been made fun of because of your looks or the way you talk? …been pushed, shoved, slapped, hit, or kicked by someone who wasn't just kidding around? …been afraid of being beaten up? …had your property stolen or deliberately damaged? …been harassed or bullied because of race, religion, gender, perceived or actual sexuality, a disability, or any other reason?
Experiences with violence or criminal behavior at school	During the past 12 months, how many times on school property have you …

(Violence) *Mean Interitem Covariance = .15* *Cronbach's Alpha = .81*	…been in a physical fight? …been threatened or injured with a weapon (gun, knife, club, etc.)? …damaged school property on purpose? …carried a gun? …carried any other weapon (such as a knife or club)? …seen someone carrying a gun, knife, or other weapon? …been offered, sold, or given an illegal drug?

Standardized scores on each of the six factors were then calculated for each student based on the weighting coefficients determined by the factor analysis. Cases where more than one item was missing from any given factor were excluded. Next, the analysis was run separately for each grade level, gender and racial/ethnic group. All yielded the same 6-factor solution with little variability in the relative weighting of items, so it was determined that in order to increase precision and to facilitate comparisons across student groups the weights from the overall model could be used universally across all student groups. Differences among student groups were analyzed using t-tests (for gender) and analysis of variance (ANOVA) for grade level and ethnic group. (See appendix table B2 for within-student correlations among factor scores.)

Converting Standardized Scores to Scale Scores

The standardized scores produced by the factor analysis show how each student or school compares to the average respondent. However, it is difficult to know from the standardized factor score whether the average student's response was generally positive or negative. In addition, standardized scores can be difficult to interpret. To address these limitations, scale scores for each factor were computed to range from 0 to 100, where 0 indicates that every item in a factor was answered with the most negative (e.g., pessimistic or critical) response option possible, and

100 indicates that every item in the factor was answered with the most positive (e.g., optimistic or supportive) possible response.. [2]

Categorizing the Factors

The six factors naturally divide into two general categories, or domains, both by content and by question type. The Feelings, Adults and Efficacy factors all focus on the student's perceptions of (or feelings about) their school. The questions that make up these factors present the students with a statement and ask them to indicate the degree to which they agree/disagree or feel it is true/untrue for them. We therefore refer to these three factors collectively as the *Perception Factors*. For these factors, a scale score around 50 indicates either neutrality or a balance of positive and negative responses.

In contrast, the items that make up the Victim, Violence and Alcohol or Drug use (AOD) scales ask students about the frequency with which they have had various (undesirable) experiences or behaviors while at school. These factors make up what we call, collectively, the *Experience* factors. For these factors, a scale score of 100 means that the student has had none of the (negative) experiences or behaviors. A score of zero would mean that a student answered the maximum frequency of behaviors or experiences for every item in the scale. As a result, the mean scores for the Experience factors are much higher—closer to 100--than those for the Perception scales.

[2] To provide more detail, for each scale, the maximum possible factor score was identified as the score calculated when a student answered every item in the given scale with the most positive answer option. Likewise, the minimum possible score was identified as the score calculated when a student answered every item in the given scale with the most negative answer option. "Shifted scores" for each student were then calculated by adding the student's individual factor score to the absolute value of the minimum possible score on that factor. This effectively shifted the scores so that the new minimum score possible was zero and the new maximum equal to the range of possible scores. Each student's shifted score was then multiplied by 100 and divided by the new maximum to yield a scale score. The scale scores provide a context for the comparison and interpretation of the students' response patterns. To summarize, each score ranges from 0 to 100 where 0 indicates the most negative possible answers and 100 indicates the most positive possible answers.

Analysis Phase II – Calculating School Effects

In this phase of analysis, probit models were used to estimate the effects of attending a given school on two academic outcomes: for middle school students we modeled the probability of being on-track in grade 9 (i.e., at the end of the first year of high school) and of graduating on-time, while for high school students we modeled the probability of graduating on-time. Being on track in grade 9 is defined as an indicator equal to one if the student earned at least 10 credits by the end of their freshman year in high school, with a Grade Point Average of at least 2.0, which is a district graduation requirement, and no more than one F in the college preparatory courses the district has required for graduation since 2016.[3]

The probit models to explain these outcomes included a set of school dummies on the right-hand side. Other explanatory variables were Grade Point Average (GPA) in math and separately for English, behavior GPA, a variable we constructed from citizenship grades that teachers give to students in every course as a report-card indicator of classroom comportment, the percentage of days the student was absent, an indicator for whether the student had ever been retained a grade, indicators for special education status and taking a version of the state test designed for severely mentally challenged students, indicator variables for English Learner status, female, whether Spanish was the home language, and missing indicators for the three GPA variables (for math, English and behavior). [4] Standard errors were clustered by student ID to take into account the correlation among observations for the same student in different grades.

[3] These calculations exclude from the course count functional skills courses for non-diploma bound students who are receiving special education.

[4] We set missing values for the three GPA variables to zero, so that the indicators for missing one of these variables will have a coefficient equal in expectation to the coefficient on the given GPA variable multiplied by the mean GPA for those missing that GPA variable.

We developed these models in past work and found them highly predictive of academic outcomes in later grades.

Sample selection for the probit models involved several decisions. First, data for students from 2009-10 through 2016-17 were used to match the time span covered by the CHKS data. Second, elementary grade levels were also excluded as the CHKS data were limited to secondary school students. Next, it was observed that a small number of specialized, atypical schools (including special education sites and alternative/dropout prevention schools) constituted outliers when looking at the distribution of the school climate data, so these schools were dropped.

Lastly, since the prediction of a student's being on-track in grade 9 is only meaningful prior to the student actually being in high school, models using this outcome only include data from students in grades 6-8. For models looking at on-time graduation, probits were run for middle schools and high schools separately as well as for all grade levels combined. In addition, separate models were run for males, females and for White, Black, Hispanic and Asian students.

Analysis Phase III – Regression modeling

In the third phase of analysis, we used feasible Generalized Least Squares (GLS) to model the estimated school fixed effects from Phase II as a function of the school climate factors from Phase I. Specifically, for each outcome (on-time graduation and on-track in grade 9,) school coefficients from Phase I were used as the dependent variable. Following Borjas and Sueyoshi (2004), suppose that the true model is that the school fixed effects y_i can be explained by a vector of explanatory variables Z_i plus an error term, where i indexes the schools:

$$y_i = Z_i\beta + \varepsilon_i$$

Here the error term has expectation zero and variance σ_ε^2. However, our estimated school effects are measured with error, so our actual second stage regression model becomes

$$\widehat{y_i} = Z_i\beta + \varepsilon_i + \nu_i$$

where the second error term reflects sampling error from the probit model. Assuming independence of the two error terms and that ν_i has expectation 0 and variance σ_i^2 we must take into account the heteroscedasticity introduced by this second error term. Feasible GLS can estimate this model efficiently by weighting each observation by the inverse of the square root of the estimated variance of observation i, where the true variance is given by $\sigma_\varepsilon^2 + \sigma_i^2$. We have an estimate of the latter variance which is based on the standard error of each school dummy in the probit model. We estimate the former variance by estimating (2) by Ordinary Least Squares, calculating the sum of squared errors SSE, and then calculating the following, where N is the number of observations and K is the number of second-stage regressors:

$$\hat{\sigma}_\varepsilon^2 = \frac{(SSE - \sum \hat{\sigma}_i^2)}{(N - K)}$$

To make the scaling easier to understand, the school fixed effects from the probit were transformed into marginal effects of attending the given school on the probability of reaching the given goal, based on sample means for other explanatory variables. These models were repeated for each gender and race/ethnicity group, as well as for the student population as a whole. Coefficients for the student characteristics in each model can be found in appendix section C.

Results

We begin by characterizing the six school climate factors and how they vary across student groups and time, before addressing the key question of whether school climate is associated with school under- and over-performance academically.

Characterizing School Climate: Student Perspectives

General Feelings about Your School (Feelings)

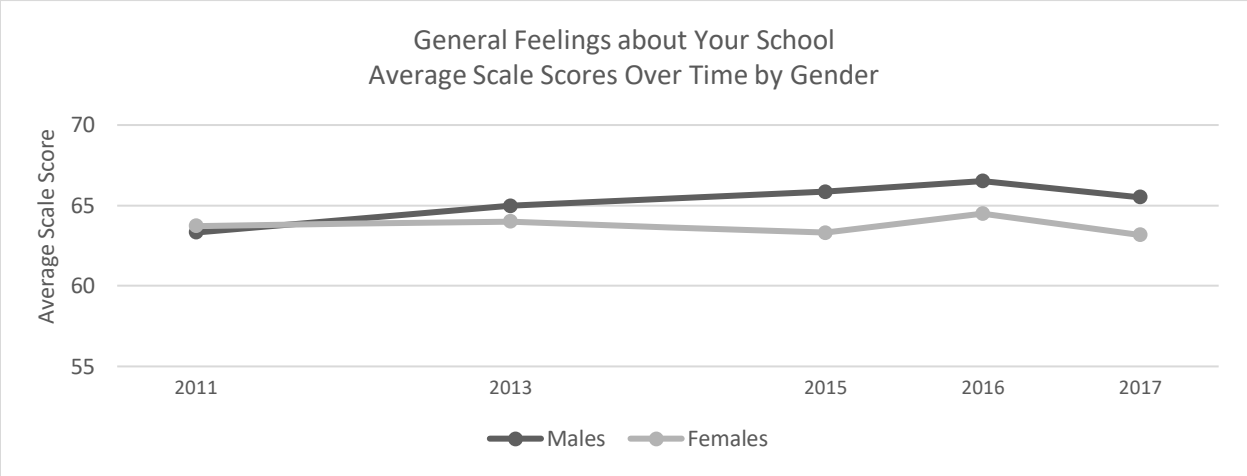
Sometimes referred to as school connectedness, scores on this scale combine several different components of a student's overall regard for his school. (See Table 1.)

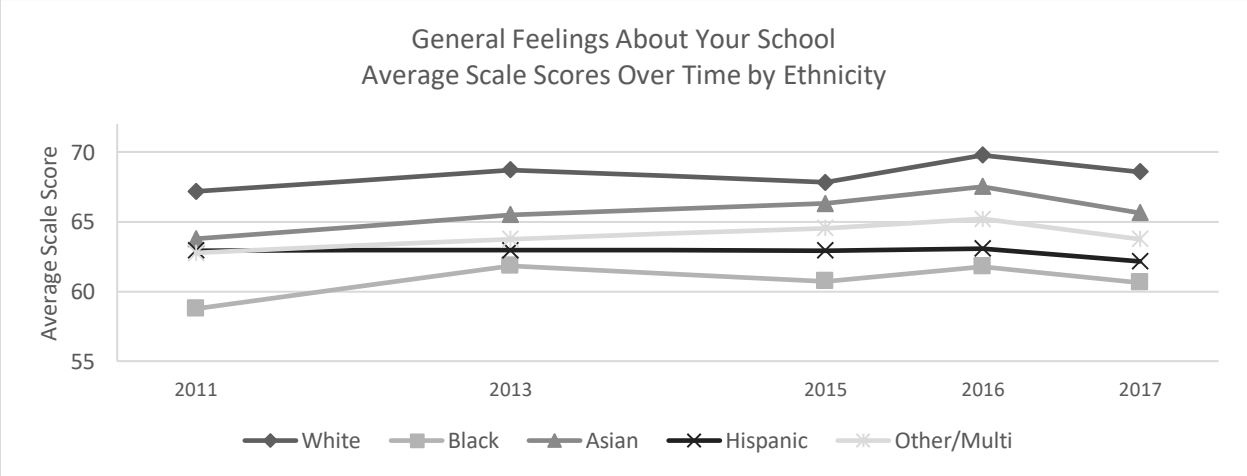
Table 2 shows differences among student groups, and Figure 1 illustrates trends over time for the Feelings scale. Middle school students reported more positive feelings than high schoolers at both 9th and 11th grade, $F(2, 79{,}244) = 333.82$, $p < .0001$. Boys felt more positively about their school than did girls ($t = 10.07$ 80,950, $p < .0001$), and the gap has widened over time. There were also significant differences by race/ethnicity, $F(4, 80{,}754) = 281.62$, $p < .0001$, with White students feeling more positively than students of color, and Black students consistently responding more negatively than their non-Black peers. Overall, there is a very slight positive linear trend over time ($F(1, 79{,}243) = 35.12$, $p<0.0001$, $R^2 = 0.0004$.)

Table 2. General Feelings About Your School Overall Scale Scores by Student Group

	General Feelings Scale Score		
Student Group	Mean	Std. Dev.	Freq.
All Students	64.30	20.52	82,296
Grade 7	67.02	20.24	29,913
Grade 9	63.23	20.09	26,582
Grade 11	63.08	20.31	22,643
Male	65.08	20.92	40,113
Female	63.65	20.03	41,231
White	68.38	20.32	17,406
Black	60.61	21.99	4,902
Asian	65.61	19.04	11,329
Hispanic	62.67	20.35	35,221
Other/Multi	63.83	20.92	12,370

Figure 1 Trends Over Time in General Feelings about School, by Student Subgroup





Supportive Adults at School Factor (Adults)

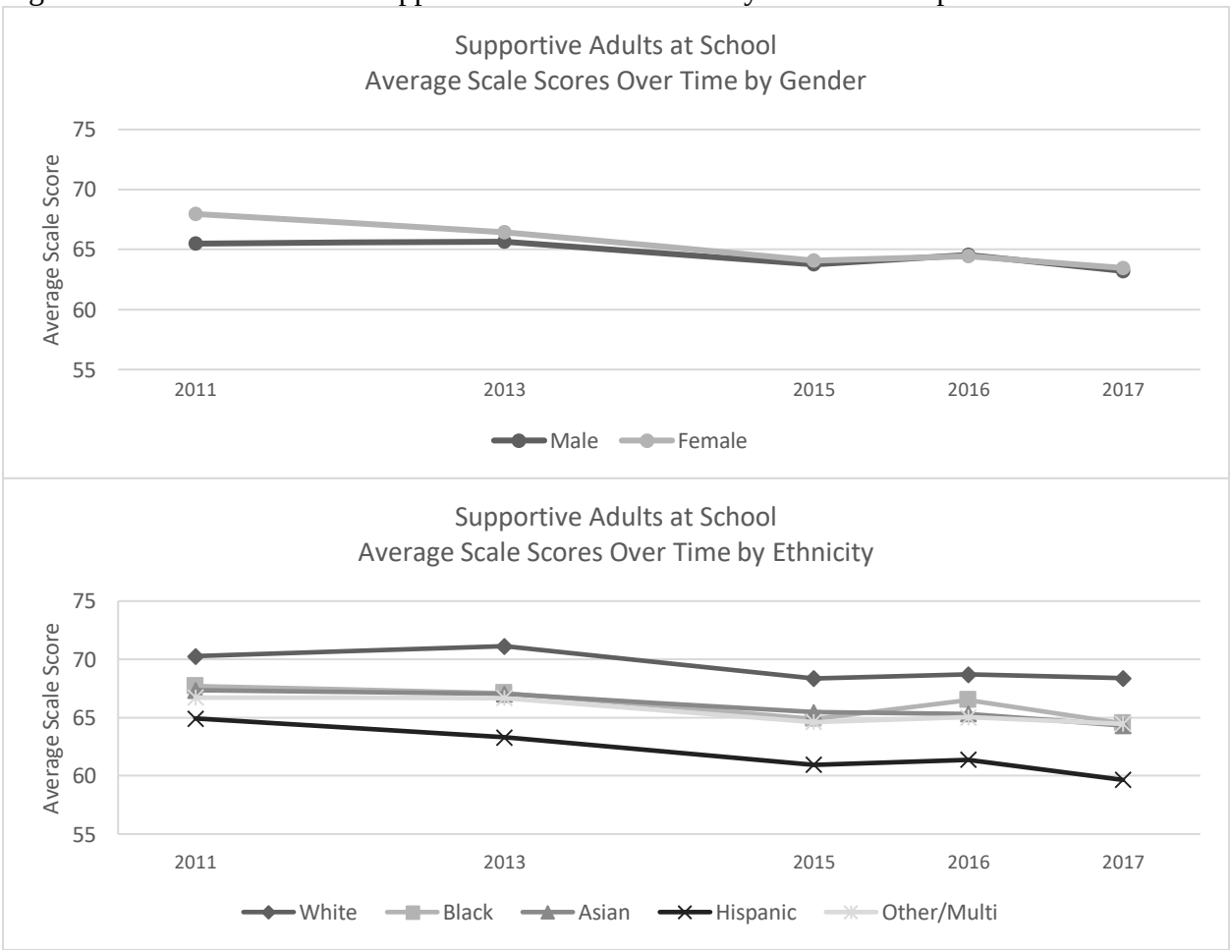
The six questions about adult supports at school are highly intercorrelated (α=.90), indicating that students do not tend to distinguish between specific types of support given, but appear to answer all items similarly. This makes interpretation of this scale straightforward: do students feel supported by at least one adult at school? (See Table 1 for items included in each scale.)

Table 3 shows mean scores by student group and Figure 2 shows trends over time. Ninth graders reported less adult support than did 7th or 11th graders, ($F(2, 81{,}387) = 240.00$, $p < .0001$,) which may be due to the fact that most students start a new school in 9th grade and have thus have had less opportunity to get to know adults on campus. Although female students tended to perceive slightly higher levels of adult support at school than male students, $t(83{,}194) = 4.53$, $p < .0001$, the differences by gender were very small, particularly in more recent years. However, larger differences were seen among racial/ethnic groups $F(4, 82{,}993) = 247.38$, $p < .0001$. White students, as a group, reported higher levels of perceived adult support than non-Whites, while Hispanic students reported much less perceived support than other groups. Overall, there is a slight negative trend over time, with students overall reporting less perceived support in recent years ($F(1, 81386) = 186.10$, $p<0.0001$, $R^2 = 0.0023$.)

Table 3. Supportive Adults at School: Overall Scale Scores by Student Group

Supportive Adults at School Scale Score			
Student Group	Mean	Std. Dev.	Freq.
All Students	64.85	25.88	83,615
Grade 7	66.84	30,577	24.73
Grade 9	62.40	27,390	25.97
Grade 11	66.12	23,308	26.24
Male	64.44	25.83	41,435
Female	65.25	25.92	42,180
White	69.28	25.34	17,655
Black	65.93	26.96	5,190
Asian	65.83	23.92	11,477
Hispanic	61.98	26.45	36,461
Other/Multi	65.41	25.39	12,719

Figure 2 Trends Over Time: Supportive Adults at School by Student Group



Sense of Efficacy at School Factor Scale (Efficacy)

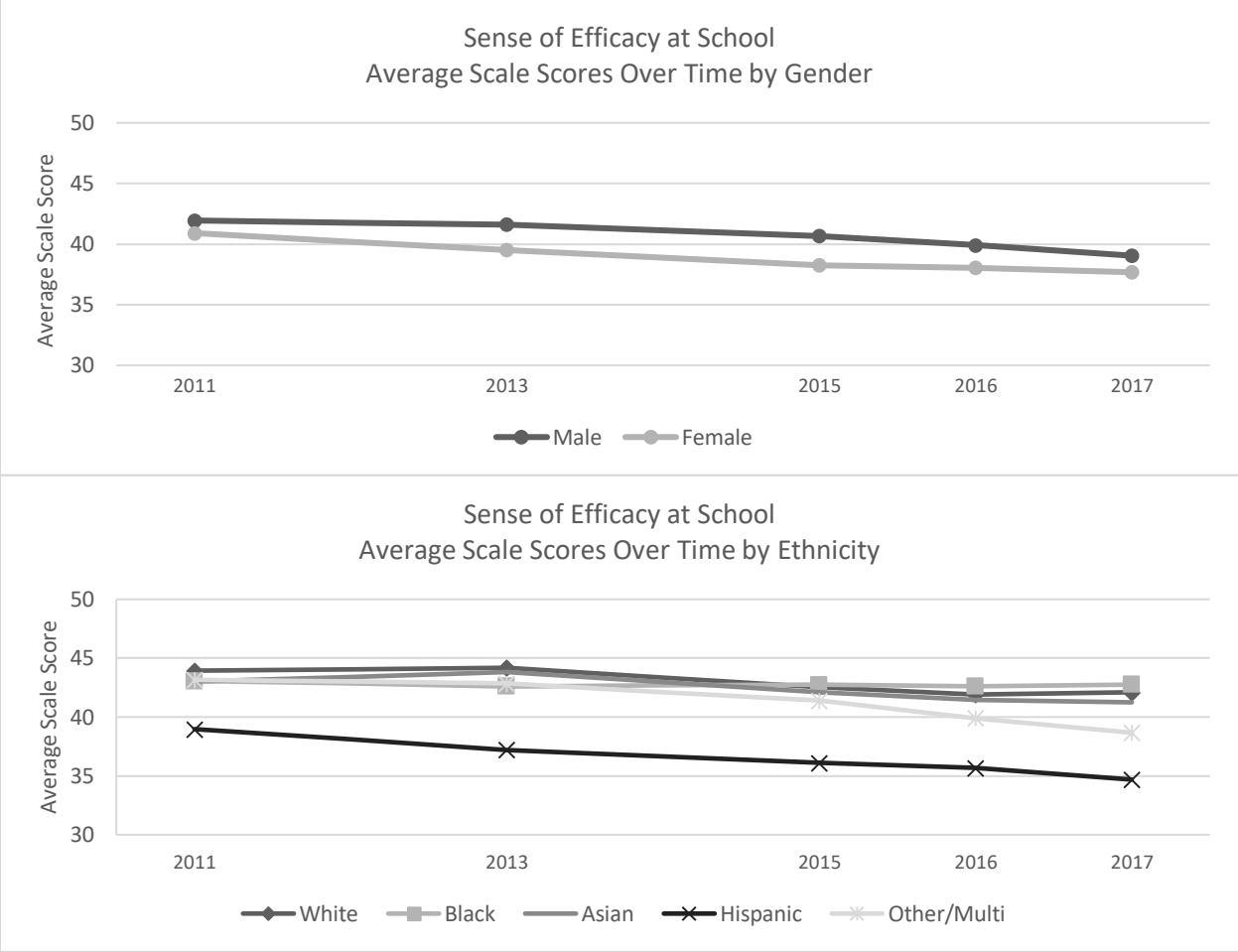
With only 3 items and a correlation coefficient of 0.77, Efficacy at School is the least robust of the factors. (See Table 1 for items included in each scale.) Table 4 and Figure 3 show group means and trends respectively. Still, significant differences were found for grade level, with students in grade 9 reporting lower sense of efficacy $F(2, 83{,}682) = 121.43$, $p < .0001$. Differences by gender also emerged $t(85{,}507) = 9.13$, $p < .0001$) with males reporting a slightly higher sense of engagement with and control over their school experience.

Analysis by race/ethnicity reveals a lower sense of efficacy for Hispanic students compared to their non-Hispanic peers $F(4, 85{,}292) = 230.84$, $p < .001$, but with the remaining groups responding to these items similarly to each other. Overall, there is a small negative linear trend over time ($F(1, 83{,}681) = 134.30$, $p<0.0001$, $R^2 = 0.0016$.)

Table 4. School Efficacy: Overall Scale Scores by Student Group

School Efficacy Scale Score			
Student Group	Mean	Std. Dev.	Freq.
All Students	39.79	27.82	85,941
Grade 7	41.45	26.89	31,756
Grade 9	37.92	27.42	28,014
Grade 11	40.14	29.09	23,792
Male	40.66	27.93	42,640
Female	38.93	27.68	43,301
White	42.91	28.32	18,075
Black	42.76	28.53	5,362
Asian	42.35	27.24	11,749
Hispanic	36.59	27.34	37,574
Other/Multi	41.30	27.65	13,056

Figure 3 Trends Over Time in Perceptions of School Efficacy, by Student Subgroup



Characterizing School Climate: Student Behaviors and Experiences

While the perception factors show the extent of positive feelings and perceptions (e.g., feeling close to people or having supportive adults,) the remaining three factors reflect the prevalence of negative experiences and behaviors on campus—violence, bullying, drug use, etc. For consistency with the earlier Perception factors, all factors are coded with the least desirable responses coded low and the most desirable responses coded high. In other words, a scale score of 100 means a complete absence of any negative behaviors or experience, Therefore, we added

"absence of" to the names of these scales to make the interpretation, particularly of the graphs, more intuitive.

Absence of Substance Use at School (Low AOD)

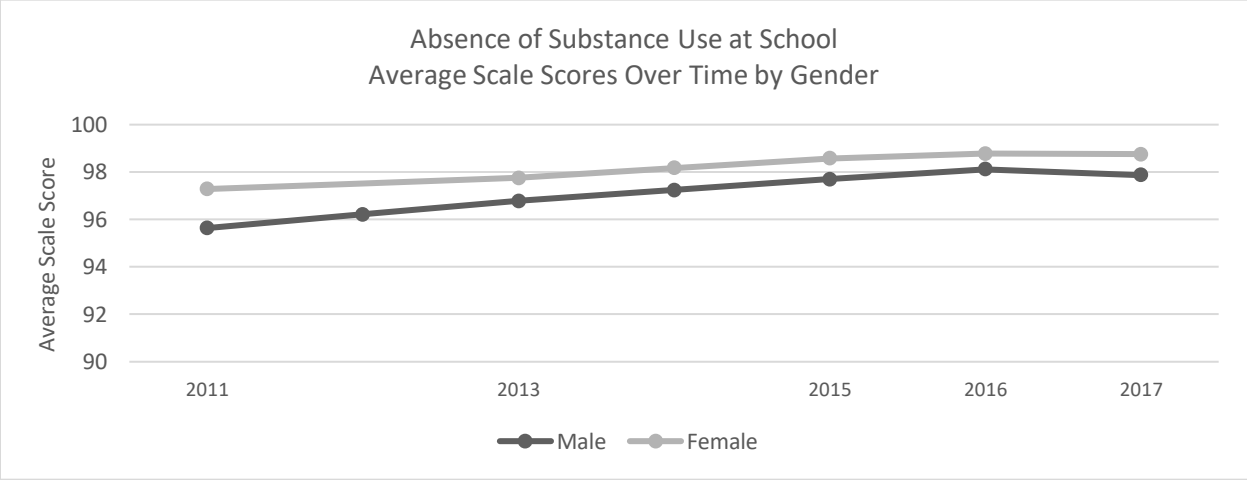
The absence of substance use at school factor includes questions about nicotine, alcohol and/or drug use on campus. As indicated by average scores close to 100, the vast majority of students—95.6% of the overall sample—report no use of substances on school campus in the previous month. (See Table 1 for items included in each scale.)

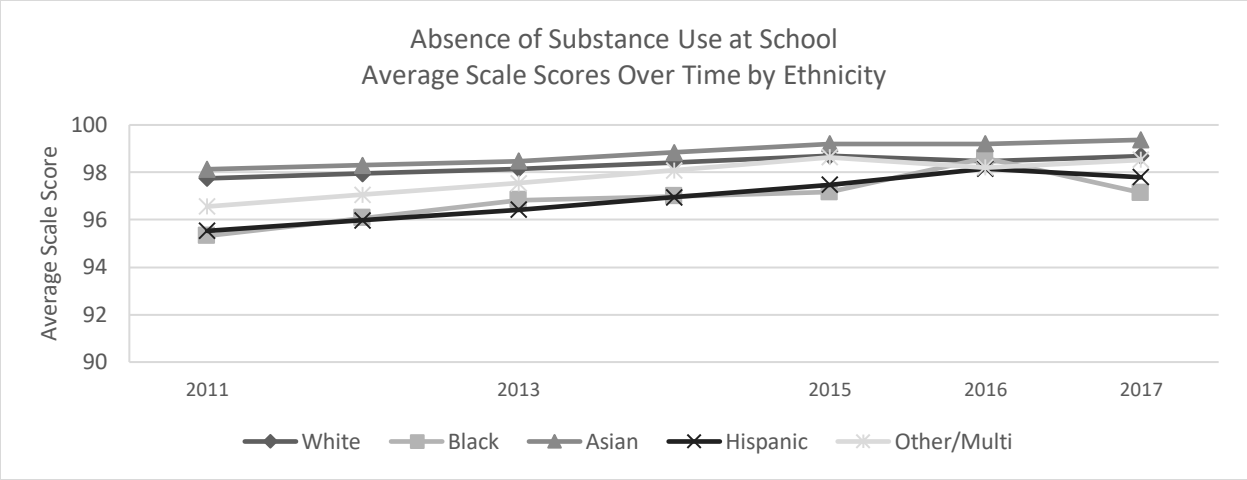
For all students combined, the average scale score for Absence of Substance Use on Campus was 97.68. Seventh graders were more likely to abstain from substance use than high schoolers, $F(2, 82{,}683) = 142.85$, $p < .0001$, and females were more likely to abstain than males, $t(84{,}461) = 13.25$, $p < .0001$). Significant differences were also found by race/ethnicity, with Black and Hispanic students reporting more campus substance use than White and Asian students, $F(4, 84{,}225) = 85.97$, $p < .0001$. Overall, there is a small positive linear trend over time ($F(1, 82{,}682) = 347.12$, $p<0.0001$, $R^2 = 0.0042$.) Trends over time were fairly consistent, with the exception of 2016, where there was a dip in reported campus substance use by Black and Hispanic students relative to prior or later years. Conversely, White students reported slightly more use in 2016 than in the previous or following year.

Table 5. Absence of Substance Use at School: Overall Scale Scores by Student Group

Absence of Substance Use at School Scale Scores			
Student Group	Mean	Std. Dev.	Freq.
All Students	97.68	11.40	84,151
Grade 7	98.60	8.86	31,413
Grade 9	97.13	12.33	27,626
Grade 11	97.35	12.28	23,520
Male	97.17	13.24	41,709
Female	98.18	9.22	42,442
White	98.36	10.06	17,860
Black	96.92	13.78	5,161
Asian	98.86	8.40	11,546
Hispanic	96.99	12.61	36,507
Other/Multi	97.84	11.08	12,775

Figure 4 Trends Over Time in Absence of Substance Use at School, by Student Subgroup





Absence of Bullying/Victimization at School (Low Victim)

The Absence of Bullying/Victimization factor includes a range of possible experiences, from being the subject of gossip to being physically assaulted on campus. (See Table 1 for items included in each scale.)

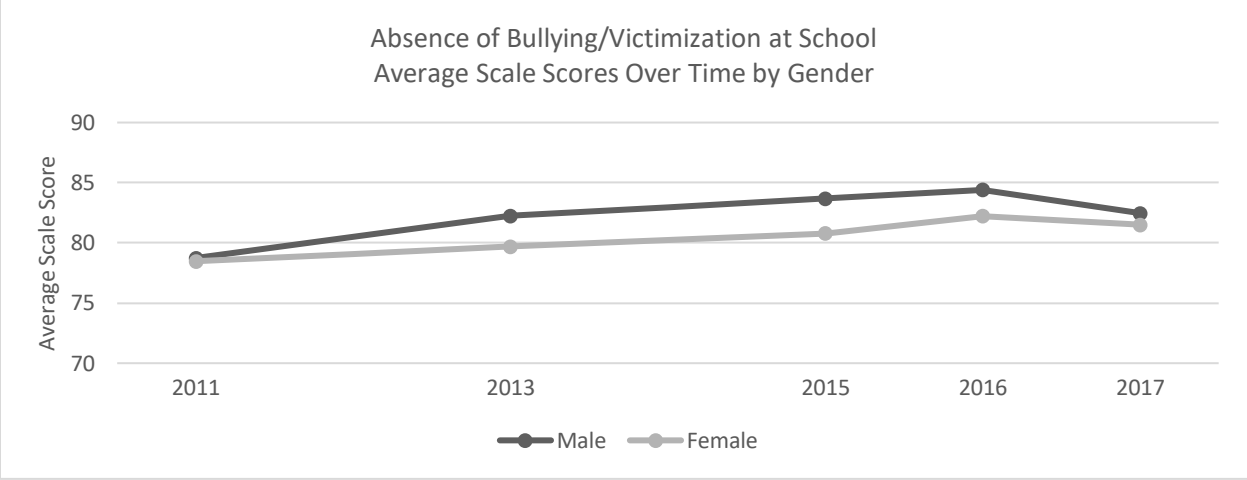
Significant differences were seen by grade level, with students encountering bullying progressively from grade 7 to 11, $F(2, 79{,}376) = 919.76$, $p < 0001$. As with the General Perceptions and School Efficacy scales, female students reported a more negative experience than did male students in terms of bullying or victimization, $t(81{,}307) = 11.58$, $p < .0001$. Racial differences were also seen, with Black students reporting more victimization than their non-Black peers (and the group of students of other or mixed ethnicities reported the most negative experiences of all racial/ethnic groups) $F(4, 80{,}853) = 65.92$, $p < 0001$. Overall, there is a positive linear trend over time ($F(1, 79{,}375) = 305.10$, $p<0.0001$, $R^2 = 0.0038$.)

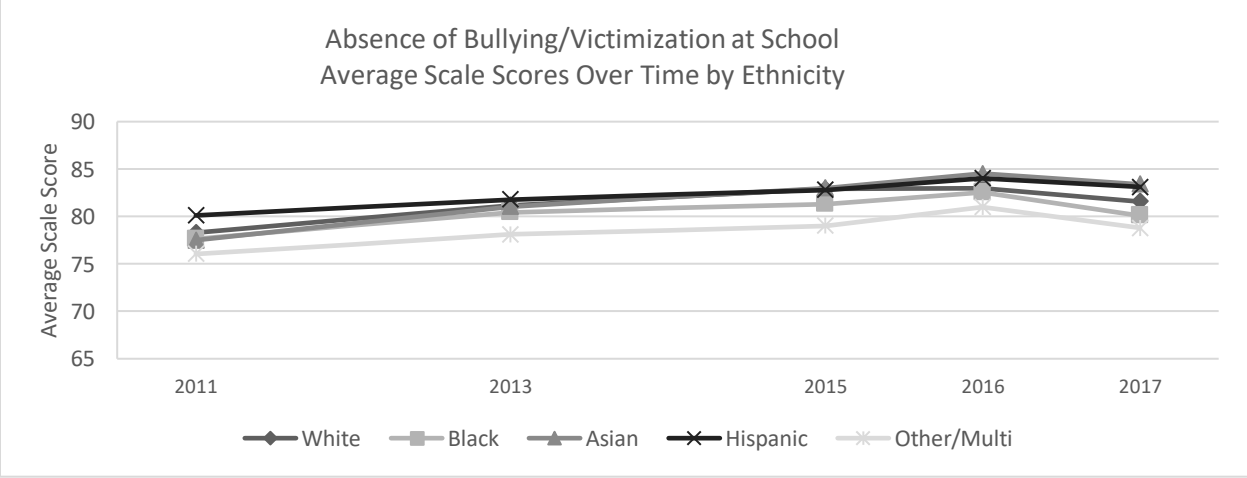
All groups display a generally positive trend over time, with students experiencing less bullying in recent years than in the early years of the study, but the 2017 data show a clear break from this trend, with all groups reporting more experiences of bullying at school than they did in 2016, as shown by a drop in the index in 2017.

Table 6. Absence of Violence/Crime at School: Overall Scale Scores by Student Group

Absence of Violence/Crime Scale Score			
Student Group	Mean	Std. Dev.	Freq.
All Students	95.13	12.61	80,887
Grade 7	95.18	12.04	30,145
Grade 9	94.88	13.04	26,493
Grade 11	95.56	12.24	22,739
Male	93.76	15.01	39,909
Female	96.48	9.55	40,978
White	96.13	11.36	17,309
Black	94.01	14.44	4,890
Asian	96.71	10.38	11,246
Hispanic	94.44	13.39	34,898
Other/Multi	94.68	13.03	12,283

Figure 5 Trends Over Time in Absence of Bullying/Victimization at School, by Student Group





Absence of Violence or Criminal Behavior at School (Low Violence)

The Absence of Violence/Criminality at School factor includes questions about experiencing or witnessing actual or potential violence or criminal behavior at school. (See Table 1 for items included in each scale.)

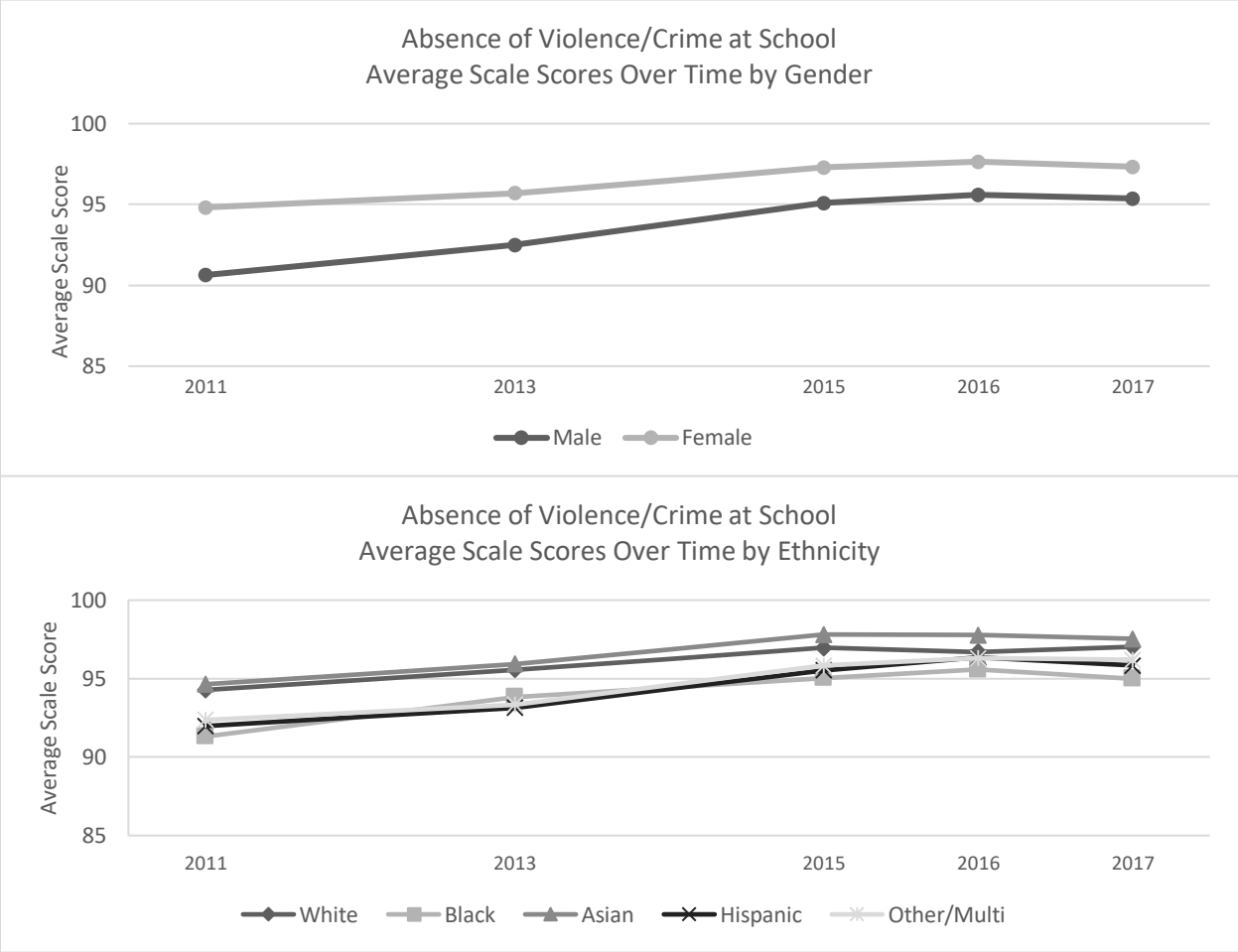
Table 6 shows mean scores by student group, while Figure 5 shows trends. Not surprisingly, males were more likely than females to report seeing or experiencing potentially violent or criminal acts on campus $t(81,166) = 30.81$, $p < .0001$. Differences by race/ethnicity were also apparent, with Black and Hispanic students reporting more experiences than White or Asian students time ($F(4, 80,958) = 113.63$, $p<0.0001$, $R^2 = 0.0134$.)

All groups show a positive trend over time $F(4, 80,953) = 113.63$, $p < 0001$, that is, there was increasingly an absence of seeing violent or criminal acts. Overall, there is a positive linear trend over time ($F(1, 79,487) = 1081.83$, $p<0.0001$, $R^2 = 0.056$.)

Table 7 Absence of Bullying/Victimization at School: Overall Scale Scores by Student Group

Absence of Bullying/Victimization Scale Score			
Student Group	Mean	Std. Dev.	Freq.
All Students	81.37	22.77	80,760
Grade 7	77.18	24.73	29,985
Grade 9	82.65	21.81	26,516
Grade 11	85.34	20.05	22,765
Male	82.31	23.37	39,829
Female	80.46	22.14	40,931
White	81.45	22.66	17,324
Black	80.33	23.50	4,866
Asian	81.85	22.34	11,242
Hispanic	82.29	22.26	34,853
Other/Multi	78.51	24.23	12,240

Figure 6 Trends Over Time in Absence of Violence/Crime at School, by Student Group



Academic Outcomes

Table 8 below shows the means of the On-Track in Grade 9 and On-Time Graduation variables overall and by student group. Because the outcomes are binary (i.e., either a student was on-track or she wasn't), the means can be read as the average proportion of students in each group who met the target academic goal. Differences between genders and ethnic groups are significant at $p<0.0001$ for both outcomes. (On Track in Grade 9: Welch's t-test for gender = 33.69, Chisquare for ethnicity = 9,800; On-Time Graduation: Welch's t-test for gender = 36.12, Chisquare for ethnicity = 4,400.)

Table 8. The Proportion of Students Attaining Each Outcome by Student Group

	On-Track in Grade 9 (Grades 6-8)			On-Time Graduation (Grades 9-12)		
Student Group	Mean	Std. Dev.	Obs.	Mean	Std. Dev.	Obs.
All Students	0.69	0.46	90,396	0.86	0.35	149,342
Male	0.64	0.48	46,142	0.82	0.38	75,989
Female	0.75	0.43	44,254	0.89	0.31	73,353
White	0.85	0.35	22,293	0.93	0.25	37,861
Black	0.60	0.49	8,515	0.81	0.39	16,051
Asian	0.87	0.33	17,237	0.92	0.27	30,811
Hispanic	0.55	0.50	40,918	0.80	0.40	61,618
Other/Multi	0.80	0.40	1,358	0.88	0.32	2,200

Overall, just over two-thirds of the middle school students in the sample were on-track (had earned at least 10 credits, had a GPA of 2.0 or higher, and had no more than one F) by the end of 9th grade. Female students were more than 10% more likely to be on track than males, and the variation by ethnic group was even greater, with a gap of 25 percentage points or more between Hispanic and Black students and their White and Asian counterparts.

A similar pattern was seen with the on-time graduation outcome among high school students. Again, female students were more likely to graduate on time than male students, and White and Asian students graduated on-time at a much higher rate than Black or Hispanic students.

Testing for an Association between School Effects and Climate Factors

General Feelings about Your School Factor

Higher scores on the General Feelings About Your School factor were associated with an increased likelihood of students meeting academic milestones. Specifically, middle schools where students, on average, felt more positively about their school tended to be schools where

students were more likely to be on-track in grade 9 than predicted based on the student variables alone. While the effect is small, it is significant for both genders and all specific ethnic groups.

Figure 7 The Relation between School Over- and Under-Performance on Students' Probability of Being On Track in Grade 9 or Graduating on Time and School Mean Scores on General Feelings about the School

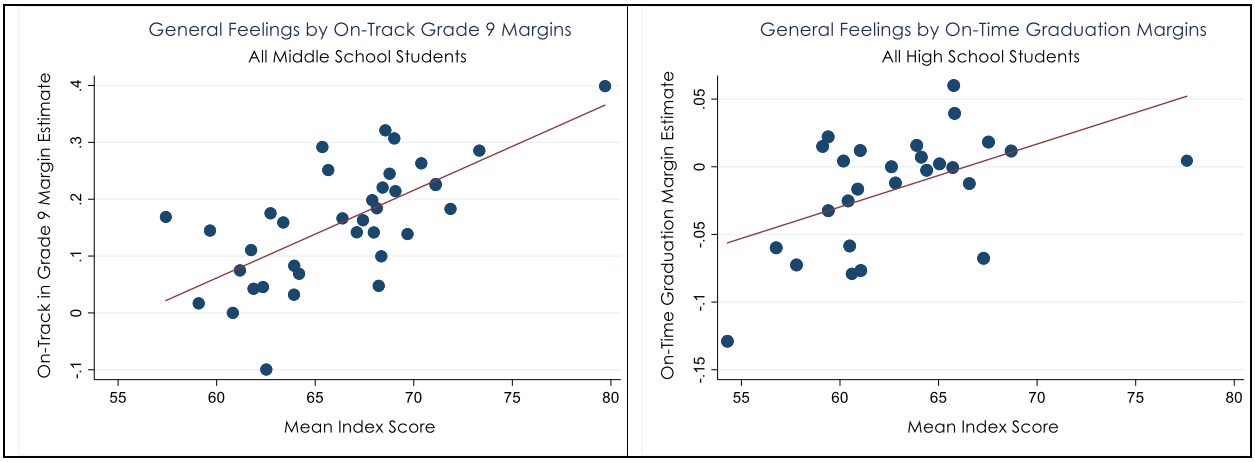


Figure 7 shows the relationship between each school's average Feelings about Your School scale score (on the horizontal axis) and the school's estimated effects on the given outcome (vertical axis). For the main outcome for middle schools, whether students are on track course-wise at the end of their first year of high school, and for the outcome we modeled for high schools, which is on-time graduation, both figures show a positive relationship. For instance, the panel on the left shows that students who attended one of the middle schools with the most positive General Feelings, compared to students who attended one of the schools with the least positive General Feelings, had a 20 to 30 percentage point increase in the probability of being on track once they completed grade 9. The panel on the right shows a similar positive relationship between General Feelings at each high school and the probability that students graduate on time. Moving from the high school with the least positive General Feelings to the top high school is predicted to increase the probability of graduating on time by only about ten percentage points.

This may seem like a small relationship but the predicted effect is large when compared to the mean on-time graduation rate of 86 percent, as shown in Table 9.

Table 9. General Feelings About School and On-Track in Grade 9 – Grades 6-8

General Feelings	obs	coefficient	standard error	F	r2
All	37	0.0142***	0.0031	20.96	0.375
Male	37	0.0140**	0.0044	10.28	0.243
Female	37	0.0100**	0.0029	12.03	0.273
White	28	0.0091*	0.0036	6.41	0.218
Black	32	0.0145*	0.0054	7.17	0.204
Asian	28	0.0058**	0.0019	9.51	0.284
Hispanic	37	0.0126*	0.0057	4.91	0.133
Other/Multi	29	0.0083	0.0051	2.71	0.094

*p<.05, **p<.01, ***p<.001

The strength of the relationship between being on track in grade 9 and the General Feelings factor is further explored in Table 9. The table shows β, that is, the coefficient on the General Feelings factor in a model of the estimated effect the school has on a student's likelihood of being On-Track in Grade 9. For all students and subgroups defined by gender and race, the coefficient is positive and significant, except for the smallest racial group ("other/multi"). This means that there is a positive correlation between general feelings students have about their middle schools and the degree to which they are likely to be on track after their first year of high school. (Note that the number of school observations varies by group, as groups with fewer than 10 students in a given school were excluded from the analyses.) The General Feelings factor is highly significant for all subgroups except a small other/multi-ethnic group. A one-unit increase in this factor is correlated with bigger changes in the probability of being on track in grade 9 for Black and Hispanic students than for White and Asian students.

Table 10 shows the relationship between the General Feelings factor for high school students and the effect of the high school on On-Time Graduation. The relationship between a school's average General Feelings scores and their students' trajectory toward on-time graduation is positive and significant for all students overall, for males, and for the Asian and Hispanic subgroups, but not significant for the other three racial/ethnic groups.

Table 10. General Feelings About School and On-Time Graduation – Grades 9-12

	obs	coefficient	standard error	F	r2
All	30	0.0051***	0.0013	15.87	0.362
Male	30	0.0077***	0.0017	20.63	0.452
Female	30	0.0017	0.0015	1.25	0.0478
White	28	0.0015	0.0015	0.97	0.0403
Black	27	0.0056	0.0030	3.46	0.126
Asian	22	0.0033*	0.0013	6.48	0.254
Hispanic	30	0.0059**	0.0021	7.88	0.240
Other/Multi	25	0.0074	0.0045	2.7	0.109

*p<.05, **p<.01, ***p<.001

Supportive Adults at School Factor

We repeated the models of the school fixed effects on the over- or under-performance of schools on the outcome variables using the scale for supportive adults as the explanatory variable. Figure 8 again shows a positive correlation overall with both outcomes. Table 11 shows that, for middle school students, the relationship between the Supportive Adults factor and the likelihood of being on-track after grade 9 is significant for middle school students overall and for females, but not for males or for racial/ethnic groups. Table 12 shows that for high school students, the relationship between the Supportive Adults score and on-time graduation is significant for the pooled sample and for males, Asians and Hispanics, but not other groups.

Table 11. Supportive Adults and On-Track in Grade 9 – Grades 6-8

Supportive Adults	obs	coefficient	standard error	F	r2
All	37	0.0103*	0.0045	5.153	0.128
Male	34	0.0039	0.0055	0.506	0.0156
Female	34	0.0082*	0.0039	4.327	0.119
White	25	0.0081	0.0051	2.456	0.0965
Black	30	0.0021	0.0083	0.0650	0.00232
Asian	26	-0.0012	0.0029	0.173	0.00717
Hispanic	34	-0.0042	0.0065	0.421	0.0130
Other/Multi	28	0.0032	0.0065	0.236	0.00898

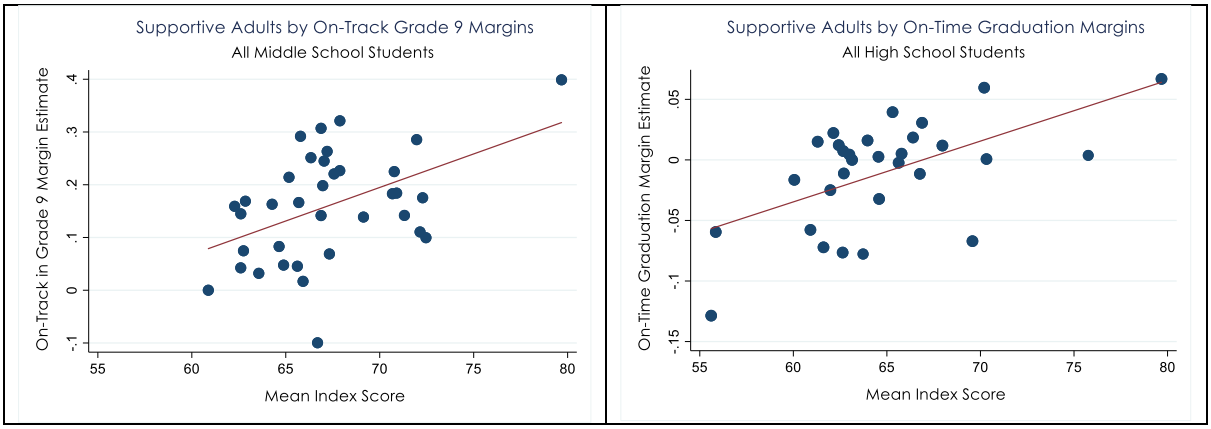
*p<.05, **p<.01, ***p<.001

Table 12. Supportive Adults and On-Time Graduation – Grades 9-12

Supportive Adults	obs	coefficient	standard error	F	r2
All	30	0.0050***	0.0013	13.60	0.327
Male	27	0.0077***	0.0015	25.87	0.509
Female	27	0.0004	0.0017	0.0489	0.00195
White	25	0.0014	0.0021	0.455	0.0194
Black	26	0.0033	0.0023	1.975	0.0760
Asian	21	0.0055*	0.0023	5.631	0.229
Hispanic	27	0.0058*	0.0024	5.773	0.188
Other/Multi	24	0.0065	0.0049	1.728	0.0728

*p<.05, **p<.01, ***p<.001

Figure 8. The Relation between School Over- and Under-Performance on Students' Probability of Being On Track in Grade 9 or Graduating on Time and School Mean Scores on Supportive Adults



Efficacy at School Factor

Like the other two perception factors, the Efficacy at School factor is positively correlated with schools' performance on both outcomes. Figure 9 shows the graphs. Table 13 shows that the correlation with being on track in grade 9 is significant for all middle school students overall and for female middle school students, but the relationship is not statistically significant for males or racial/ethnic groups.

Table 14 shows that, again, the correlation with on-time graduation is significant for all high school students. But for gender, the opposite pattern emerges when we model on-time graduation for high schools, where efficacy is significantly linked to graduation on time for males only. Without exception, for these two outcomes the racial/ethnic group correlations of efficacy with student outcomes are not significant.

Table 13. School Efficacy and On-Track in Grade 9 – Grades 6-8

School Efficacy	obs	coefficient	standard error	F	r2
All	37	0.0193***	0.0052	13.83	0.283
Male	34	0.0050	0.0057	0.756	0.0231
Female	34	0.0125**	0.0038	10.90	0.254
White	25	0.0046	0.0042	1.228	0.0507
Black	30	-0.0053	0.0056	0.890	0.0308
Asian	26	0.0002	0.0025	0.00786	0.000327
Hispanic	34	0.0047	0.0079	0.346	0.0107
Other/Multi	28	0.0100	0.0078	1.623	0.0588

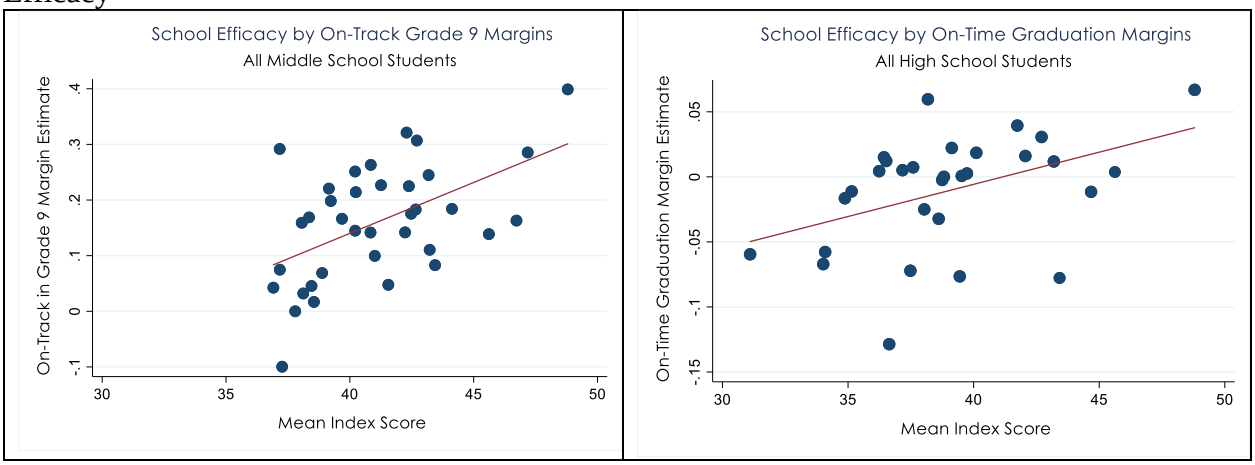
*p<.05, **p<.01, ***p<.001

Table 14. School Efficacy and On-Time Graduation – Grades 9-12

School Efficacy	obs	coefficient	standard error	F	r2
All	30	0.0046*	0.0020	5.464	0.163
Male	27	0.0058*	0.0025	5.253	0.174
Female	27	0.0018	0.0017	1.084	0.0416
White	25	0.0016	0.0015	1.198	0.0495
Black	26	0.0041	0.0034	1.510	0.0592
Asian	21	0.0016	0.0020	0.620	0.0316
Hispanic	27	0.0035	0.0026	1.755	0.0656
Other/Multi	24	0.0160	0.167	0.00920	0.000418

*p<.05, **p<.01, ***p<.001

Figure 9. The Relation between School Over- and Under-Performance on Students' Probability of Being On Track in Grade 9 or Graduating on Time and School Mean Scores on School Efficacy



Absence of Bullying/Victimization at School Factor

Figure 10 shows that the Absence of Bullying/Victimization factor at the middle school level has virtually no association with the effect of the school on whether students subsequently are on track after grade 9, and only a very slight positive correlation at the high school level with whether students graduate on time. Tables 16 and 17 show that, for the most part, there is no significant correlation between the reported absence of bullying/victimization at school and the school effect on either of the two outcomes overall or for subsamples. A notable exception is that

there is a positive and highly significant association between absence of bullying at the high school level and the effect of the school on on-time graduation for Asian students. For Asian high school students, a 10-point difference in the average absence of bullying scale score is associated with a 14-percentage point difference in the estimated effect of the school on the likelihood of Asian students to graduate on time.

Table 15. Absence of Bullying and On-Track in Grade 9 – Grades 6-8

Absence of Bullying	obs	coefficient	standard error	F	r2
All	37	0.0018	0.0054	0.114	0.00325
Male	34	-0.0113	0.0056	4.092	0.113
Female	34	0.0033	0.0049	0.450	0.0139
White	25	0.0015	0.0042	0.131	0.00567
Black	30	0.0067	0.0066	1.020	0.0352
Asian	26	-0.0022	0.0028	0.628	0.0255
Hispanic	34	-0.0119	0.0060	3.884	0.108
Other/Multi	28	-0.0070	0.0058	1.440	0.0525

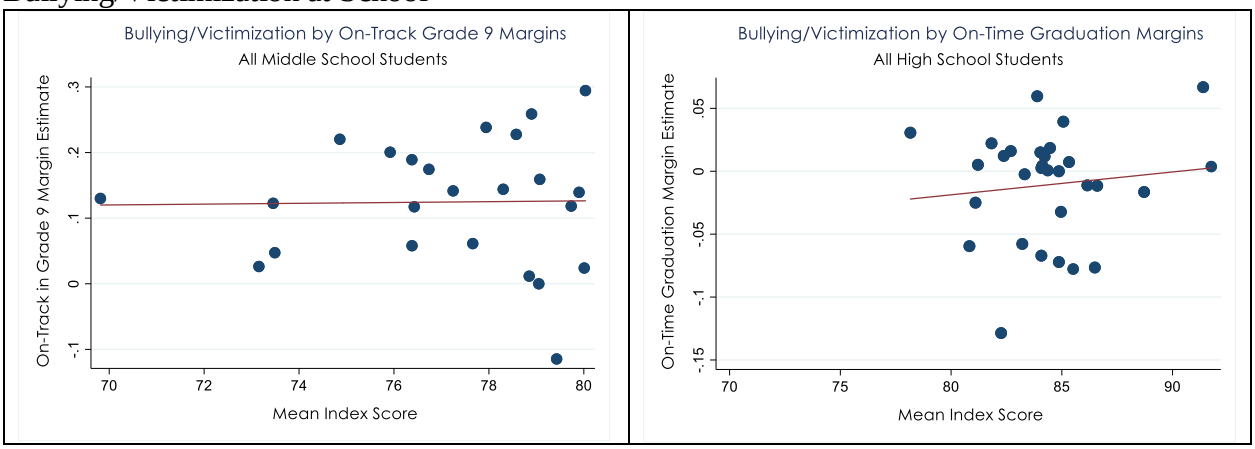
*p<.05, **p<.01, ***p<.001

Table 16. Absence of Bullying and On-Time Graduation – Grades 9-12

Absence of Bullying	obs	coefficient	standard error	F	r2
All	30	0.0037	0.0029	1.619	0.0547
Male	27	0.0007	0.0053	0.0189	0.000754
Female	27	0.0008	0.0025	0.109	0.00435
White	25	0.0005	0.0012	0.139	0.00599
Black	26	0.0017	0.0050	0.117	0.00486
Asian	21	0.0056***	0.0013	17.58	0.481
Hispanic	27	0.0009	0.0056	0.0265	0.00106
Other/Multi	24	0.0103	0.0071	2.144	0.0888

*p<.05, **p<.01, ***p<.001

Figure 10. The Relation between School Over- and Under-Performance on Students' Probability of Being On Track in Grade 9 or Graduating on Time and School Mean Scores on Absence of Bullying/Victimization at School



Absence of Violence/Crime at School Factor

The scale for absence of violence and crime at the school, like other factors, is positively correlated with the two outcomes. As shown in Figure 11, the range among schools in student responses was very low, especially at middle schools, with average scores clustered near the maximum score of 100, signifying virtually no reports of violence/crime.

Table 17. Violence and On-Track in Grade 9 – Grades 6-8

Absence of Violence	obs	coefficient	standard error	F	r2
All	37	0.789***	0.134	34.49	0.496
Male	34	0.522**	0.150	12.16	0.275
Female	34	0.580***	0.132	19.40	0.377
White	25	0.176	0.199	0.778	0.0327
Black	30	0.326*	0.157	4.279	0.133
Asian	26	0.0569	0.106	0.291	0.0120
Hispanic	34	0.401*	0.192	4.342	0.119
Other/Multi	28	0.0372	0.246	0.0228	0.000876

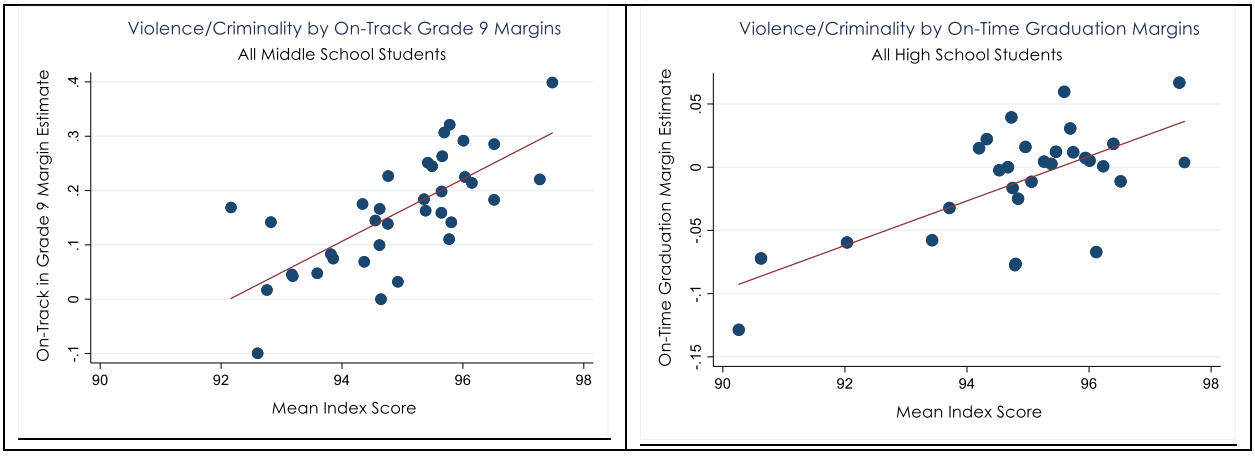
*p<.05, *p<.01, ***p<.001

Table 18. Violence and On-Time Graduation – Grades 9-12

Absence of Violence	obs	coefficient	standard error	F	r2
All	30	0.0173***	0.0039	20.09	0.418
Male	27	0.0226***	0.0049	21.67	0.464
Female	27	0.0093*	0.0034	7.615	0.233
White	25	0.0039	0.0019	4.032	0.149
Black	26	0.0104	0.0052	4.014	0.143
Asian	21	0.0086**	0.0026	11.21	0.371
Hispanic	27	0.0230**	0.0066	12.25	0.329
Other/Multi	24	0.0122	0.0099	1.514	0.0644

*p<.05, **p<.01, ***p<.001

Figure 11. The Relation between School Over- and Under-Performance on Students' Probability of Being On Track in Grade 9 or Graduating on Time and School Mean Scores on Absence of Violence/Crime



All students pooled together, and both females and males show a positive and significant relationship between absence of violence/crime at the school and our main outcome variables. When racial/ethnic groups were analyzed independently, however, the relationship was statistically significant for only Black and Hispanic students at middle school and Asian and Hispanic students at the high school level. For both samples and outcomes, the strength of the relationship was higher for Hispanic students than for students from other groups.

Absence of Substance Use at School

Overall and for both genders independently, the Absence of Substance Use on Campus was positively and significantly correlated with both a middle school's effect on the On-Track in Grade 9 outcome and a high school's effect on the On-Time Graduation outcome. As with the other factors, the relationships within racial/ethnic groups were less consistent, with only the White student group at middle school and the Black and Hispanic groups at high school showing a statistically significant relationship between the substance use measure and the school's effect on the outcomes.

Table 19. Absence of Substance Use on Campus and On-Track in Grade 9 – Grades 6-8

Absence of Substance Use	obs	coefficient	standard error	F	r2
All	37	0.0989***	0.0171	33.66	0.490
Male	34	0.0458**	0.0165	7.664	0.193
Female	34	0.0626***	0.0147	18.07	0.361
White	25	0.1090*	0.0392	7.693	0.251
Black	30	0.0132	0.0128	1.058	0.0364
Asian	26	-0.0063	0.0148	0.183	0.00757
Hispanic	34	0.0349	0.0230	2.303	0.0671
Other/Multi	28	0.0154	0.0231	0.443	0.0168

*p<.05, **p<.01, ***p<.001

Table 20. Absence of Substance Use on Campus and On-Time Graduation – Grades 9-12

Absence of Substance Use	obs	coefficient	standard error	F	r2
All	30	0.0156***	0.0030	26.35	0.485
Male	27	0.0196***	0.0037	28.65	0.534
Female	27	0.0087**	0.0031	7.992	0.242
White	25	0.0039	0.0023	2.981	0.115
Black	26	0.0096**	0.0033	8.577	0.263
Asian	21	0.0041	0.0026	2.477	0.115
Hispanic	27	0.0204***	0.0053	14.90	0.374
Other/Multi	24	0.0088	0.0142	0.386	0.0173

*p<.05, **p<.01, ***p<.001

Figure 12. The Relation between School Over- and Under-Performance on Students' Probability of Being On Track in Grade 9 or Graduating on Time and School Mean Scores on Absence of Campus Alcohol/Drug Use

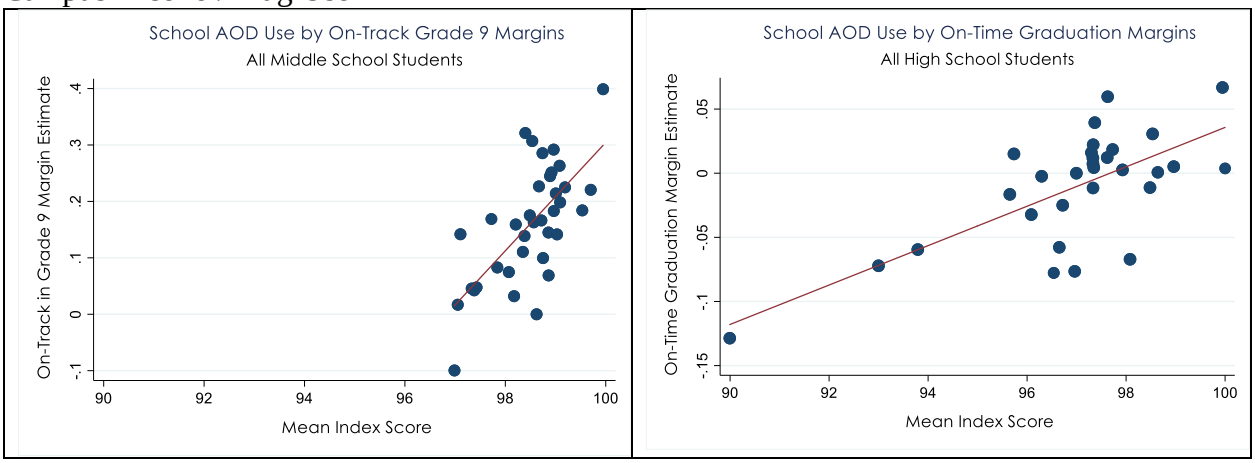


Table 21. Explanatory Power of School Climate Factors on On-Track in Grade 9 Outcome

On-Track in Grade 9, Grades 6-8	Coef.	Std. Err.	t	P>t
General Feelings about School Score	0.152	0.109	1.39	0.174
Supportive Adults at School Score	-0.103	0.127	-0.81	0.422
Sense of Efficacy at School Score	0.274	0.207	1.32	0.196
Absence of Substance Use on Campus Score	0.393	0.312	1.26	0.218
Absence of Bullying/Victimization Score	-0.205	0.113	-1.81	0.080
Absence of Violence/Crime on Campus Score	0.423	0.456	0.93	0.362
Constant	0.081	0.038	2.15	0.040
R^2	0.645			

Table 22. Explanatory Power of School Climate Factors on On-Time Graduation Outcome

On-Time Graduation, Grades 9-12	Coef.	Std. Err.	t	P>t
General Feelings about School Score	0.039	0.086	0.45	0.656
Supportive Adults at School Score	0.003	0.099	0.03	0.973
Sense of Efficacy at School Score	0.046	0.081	0.57	0.575
Absence of Substance Use on Campus Score	-0.027	0.174	-0.15	0.879
Absence of Bullying/Victimization Score	-0.083	0.079	-1.04	0.307
Absence of Violence/Crime on Campus Score	0.183	0.139	1.32	0.201
Constant	0.010	0.014	0.68	0.501
R^2	0.518			

School Climate Factors Combined

The results in Tables 10 through 20 reflect models in which the outcome variable was regressed on each school climate factor independently. Tables 21 and 22 show the results of the regression when all six school climate factors were entered into the model together. Although no factor individually was statistically significant for either outcome, the overall models had strong explanatory power, accounting for approximately 65% of the variance in middle school effects on On-Track in Grade 9 ($F(6, 30) = 9.08$, $p < .0001$, $r^2 = .645$, adjusted $r^2 = .574$) and approximately 52% of the variance in high school effects on On-Time Graduation ($F(6, 23) = 4.12$, $p < .001$, $r^2 = .518$, adjusted $r^2 = .394$). The models show signs of collinearity, with some of the explanatory variables switching signs from the models with a sole school climate factor, and with generally large standard errors. The conclusion is that collinearity between the school climate measures is an issue, but there is no doubt that taken as a whole, school climate can explain much of the between-school variations in student outcomes.

Other School-Level Variables

The school fixed effects used as the dependent variables in our analyses reflected the demographics of a school's student body indirectly. That is, the probit models took into account things such as English Learner status and special education status (see the section "Analysis Phase 2" for the specific variables included in the models) when predicting a student's likelihood of either being on track in grade 9 or of graduating on time. Therefore, the fixed school effects, which reflect the school's performance relative to those predictions, accounts for the influence of these variables on the individual student. But student body demographics on a collective level may impact overall school climate.

To investigate the potentially confounding influence of student body characteristics on school climate factors, we repeated the second stage models (with the school fixed effects as the dependent variable,) adding school-level characteristics including school size, percent of students who are English Learners, percent with parents who attended college, and percent receiving free or reduced-price lunch, as regressors. When these school demographic variables were included in the models along with each school climate factor, the contribution of the school climate factor became insignificant in every case except for the Absence of Violence factor for middle schools on the on-track in grade 9 outcome, which remained statistically significant at the .05 level. However, the intercorrelation between the school climate and school demographic variables was high, making interpretation difficult. (See appendix section D for correlation matrices. The percentages of students whose parents had a college education and whose families were low income were typically the two variables with the strongest correlations with the school climate variables.)

Conclusions

This research shows that it is possible to extract reliable measures of school climate which also have interpretations that are fairly easy to understand, and further, that these measures, to varying extents, can partially explain why students at a given school have historically performed better or worse than expected on our two measures of educational attainment. Overall, the scales can explain a large portion of the variation across schools in the degree to which their students do better or worse than predicted based on the student characteristics we used to forecast student outcomes. For the on-track in grade 9 outcome, the middle school climate scores, when combined, explained about 65% of the variation across schools in under- or over-performance. Adding the school level demographics to this

comprehensive model resulted in only a 2% increase in the predictive power to 67%. For the on-time graduation outcome, the combined high school climate scores explained about 52% of the variation across schools in under- or over-performance. However, adding the school level demographics to this model increased the R^2 to nearly 75%, suggesting that there may be less collinearity between school climate and student body demographics at the high school level compared to middle school. Notably, our predictive models included a host of individual student baseline characteristics including grades, classroom behavior and attendance, as well as demographic information. This means that our measures of school performance already control for these characteristics, and that the school climate measures can explain much of the across school variation that already takes into account individual student characteristics.

That said, we also found that the school climate variables were highly collinear with various measures of the demographics of the overall student body.

During the course of this study, WestEd, the publisher of the CHKS survey, began to include a set of "scale scores" in their reporting of school results that very closely matches the set of scales developed here. Our Supportive Adults and School Efficacy scales include exactly the same items as WestEd's "High expectations and caring relationships" and "Opportunities for meaningful participation" scales, respectively, and the General Feelings scale combines the items WestEd includes in their "School Connectedness" and "Perceived School Safety" scales. (The results of our factor analysis suggested that a scale including all six items in our General Feelings scale was a stronger factor than when the items were split into separate scales.) WestEd's "Low substance use at school" scale used the same items as our Absence of Substance Use at School scale, but there were slight differences in the final two scales. Our Absence of Violence/Crime on Campus scale included all of the items in WestEd's "Low violence perpetration" scale but

also included the question, “Have you been in a physical fight at school?” Our Absence of Bullying/Victimization factor included all of the items that comprise WestEd’s “Low violence and victimization” and “Low harassment and bullying” scales, as well as the item, “Have you been pushed, shoved, slapped, hit, or kicked by someone who wasn’t just kidding around?” The similarities between the two sets of scales are further evidence of both models’ validity.

The results of this study suggest that some scales may be more closely related to academic outcomes than others. Overall, every school climate factor other than Absence of Bullying was a significant predictor of a school’s estimated “value added” in terms of both being on-track in grade 9 and graduating on-time from high school. The strongest predictors tended to be absence of violence/criminality and absence of substance use on campus. Visual evidence of the link between the school climate indicators and school under- or over-performance was usually quite evident. However, collinearity between the six school climate measures is an issue.

It is important to remember when considering these relationships between school climate and educational outcomes that the direction of causality is indeterminate. That is, there is no way to determine from the present study whether variations in aspects of school climate lead students to perform better or worse than expected, or whether the climate variations are an outcome, a result of other factors that lead to student performance differences among different schools. Benbenishty et al. (2016) found that that changes in student performance at a school can be detected *before* changes in measures of school climate.

While there are certainly aspects of school climate that are not tapped by the CHKS survey, this study lays the groundwork for a new approach to school climate research that focuses on disentangling the various school climate factors in order to better define and understand the role of each in the broad, amorphous construct known as school climate.

The variations in predictive strength among different student groups also suggests the importance of the interaction of school climate with aspects of the larger cultural climate in which students live and operate. Although the overall factors appear to be consistent among different student groups, the strength of each factor's relationship to overall performance is not. For instance, absence of bullying or victimization on campus was not predictive of either outcome for students overall or for any specific student group except for Asian high school students for on-time graduation, where the degree of bullying/victimization reported among Asian students explains nearly 50% of the variation in on-time graduation. This difference for Asians is quite striking. Attempts to replicate this finding elsewhere would be welcome.

Further research is needed to look more deeply into the direction and mechanisms of causality, as well as to identify other aspects of school climate not evident from survey instruments such as the CHKS. Other academic and behavioral outcomes should also be examined in order to further unpack the complex relationship between campus climate and student achievement. Though the direction of causality is still unknown, the findings of this study suggest that, when addressing school climate, efforts to reduce violence and substance use on campus may be a critical area of focus in terms of the school's ability to impact overall student academic achievement. School districts that use the CHKS or similar surveys are also advised to look carefully at discrepancies among different student groups. Close examination of the data and self-reflection at the school and district levels can help reveal unintended pockets of inequity that may exist, as well as identify areas where focused efforts to address student perceptions of inequity might be needed to ensure that all students feel connected to, supported by and engaged in their school communities.

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Appendix

Appendix Section A. Response Rates and Sample Composition

Table A1. Response Rates by Grade Level (Based on Total District Enrollment)

	7th grade		9th grade		11th grad		All Grades	
	N	% of Enrt.	N	% of Enrt.	N	% of Enrt.	N	% of Enrt.
2011	6,611	72.3%	6,170	60.7%	5,619	70.7%	18,400	67.5%
2013	6,818	77.7%	6,674	65.6%	5,867	78.2%	19,359	73.2%
2015	7,157	85.7%	6,348	73.3%	5,491	69.2%	18,996	76.1%
2016	6,646	77.8%	5,358	63.2%	4,219	55.9%	16,223	66.0%
2017	6,485	77.4%	5,098	60.7%	4,409	56.3%	15,992	65.0%
2018	7,344	87.5%	5,534	65.6%	4,201	53.6%	17,079	69.2%
All Years	41,061	79.6%	35,182	64.8%	29,806	64.0%	10,649	69.5%

Table A2. Percentage of Sample vs. Percentage of District Enrollment (averaged) for each Student Group

	% Female		White	Black	Asian	Hispanic	Other
2011	50.7%		18.9%	7.2%	13.1%	44.3%	16.5%
2013	50.0%		19.2%	6.6%	13.1%	46.1%	15.0%
2015	49.7%		19.4%	6.7%	13.5%	46.0%	14.3%
2016	49.5%		21.9%	6.3%	13.8%	43.0%	15.0%
2017	50.2%		21.2%	5.6%	13.1%	46.3%	13.8%
All Years	50.0%		20.9%	6.4%	13.6%	43.8%	15.3%
Average District Enrt	50%		23.2%	9.7%	14.3%	46.5%	6.4%

Appendix Section B: School Climate Factors

Table B1**:** Factor Loadings and Communalities Based on a factor Analysis with Promax Rotation for 33 Common Items in the CHKS Core Module

	Feelings	Adults	Efficacy	Victim	Violence	School AOD	Uniqueness[5]
Feel happy to be at this school	0.861						0.293
Feel safe in my school	0.811						0.352
Feel like part of this school	0.802						0.304
Feel close to people at school	0.725						0.493
Teachers treat students fairly	0.576						0.559
How safe do you feel at school	0.531						0.557
School adult wants me to do my best		0.858					0.293
School adult who listens to me		0.827					0.303
School adult believes I will be a success		0.826					0.302
School adult tells me I do a good job		0.807					0.328
School adult who really cares about me		0.772					0.359
School adult notices when I'm not there		0.754					0.431
I help decide things like class activities			0.854				0.280
I do things that make a difference			0.823				0.269
I do interesting activities			0.687				0.401
Been made fun of for looks/speech				0.847			0.373
Been harassed or bullied				0.793			0.439
Had mean rumors about you				0.790			0.418
Had sexual comments made to you				0.714			0.501
Been pushed, hit, or kicked				0.615			0.526

[5] Uniqueness is the proportion of the common variance of the variable not associated with the factors; uniqueness is equal to 1 – communality.

Been afraid of being beaten up				0.605			0.581
Had your property stolen or damaged				0.520			0.570
Carried any other					0.868		0.347
Carried a gun					0.740		0.369
Seen someone carrying a weapon					0.730		0.479
Been threatened/injured with weapon					0.716		0.423
Damaged school property on purpose					0.686		0.487
Been in a physical fight					0.590		0.564
Been offered/sold an illegal drug					0.484		0.656
Past month on campus drank alcohol						0.886	0.209
Past month on campus used other drug						0.885	0.197
Past month on campus used cigarettes						0.881	0.203
Past month on campus used marijuana						0.840	0.266

(Only loadings above .3 are shown.)

Table B2. Correlations among School Climate Factor Scores – All Students in All Grades

	Feelings	Adults	Efficacy	Victim	Violence
General feelings about your school (*Feelings*)	--				
Supportive adults at school (*Adults*)	0.502	--			
Sense of efficacy at school (*Efficacy*)	0.411	0.483	--		
Experiences of bullying or victimization at school (*Victim*)	0.284	0.132	0.071	--	
Experiences with violence or crime at school (*Violence*)	0.246	0.178	0.073	0.456	--
Alcohol or Drug use at school (*School AOD*)	0.185	0.154	0.060	0.196	0.527

Appendix section C. Explanatory Power of Student Characteristics

Table C1. Coefficients for Demographic Variables of Students in Grade 7 on On-Track in Grade 9 Outcome

		All Students	Male	Female	Asian	Black	Hispanic	White
ELA Grade Point Average (GPA)	Coef.	0.261**	0.275**	0.284**	0.261**	0.284**	0.257**	0.316**
	SE	(0.0313)	(0.0157)	(0.0172)	(0.0313)	(0.0225)	(0.0167)	(0.0225)
Math Grade Point Average (GPA)	Coef.	0.278**	0.267**	0.277**	0.278**	0.235**	0.239**	0.280**
	SE	(0.0244)	(0.0142)	(0.0178)	(0.0244)	(0.0205)	(0.0135)	(0.0208)
Classroom Behavior GPA	Coef.	0.482**	0.451**	0.490**	0.482**	0.375**	0.481**	0.443**
	SE	(0.0503)	(0.0268)	(0.0367)	(0.0503)	(0.0385)	(0.0262)	(0.0618)
Percent of days absent	Coef.	-0.0384**	-0.0259**	-0.0313**	-0.0384**	-0.0211**	-0.0267**	-0.0249**
	SE	(0.00533)	(0.00433)	(0.00444)	(0.00533)	(0.00582)	(0.00273)	(0.00436)
Ever Retained	Coef.	-0.0759	-0.0568*	-0.0547	-0.0759	0.0710	-0.0471	-0.153*
	SE	(0.0651)	(0.0258)	(0.0365)	(0.0651)	(0.0880)	(0.0299)	(0.0630)
Special Education	Coef.	-0.625**	-0.447**	-0.449**	-0.625**	-0.678**	-0.372**	-0.328**
	SE	(0.0775)	(0.0320)	(0.0553)	(0.0775)	(0.0638)	(0.0405)	(0.0490)
Ever Took CAPA	Coef.	-1.972**	-2.451**	-2.670**	-1.972**	-1.817**	-2.620**	-2.849**
	SE	(0.444)	(0.234)	(0.320)	(0.444)	(0.392)	(0.334)	(0.532)
English Learner	Coef.	-0.235**	-0.188**	-0.206**	-0.235**	0.0491	-0.445**	-0.341*
	SE	(0.0876)	(0.0509)	(0.0649)	(0.0876)	(0.123)	(0.0509)	(0.133)
Fluent English Proficient	Coef.	0.0990*	0.130**	0.120*	0.0990*	0.170	-0.0892*	0.0673
	SE	(0.0464)	(0.0383)	(0.0552)	(0.0464)	(0.107)	(0.0409)	(0.129)
Female	Coef.	-0.0673	0.237	0.507**	-0.0673	0.0594	-0.0631*	-0.109*
	SE	(0.0457)	(0.137)	(0.194)	(0.0457)	(0.0415)	(0.0307)	(0.0454)
Missing ELA GPA	Coef.	-0.281	0.400**	0.516*	-0.281	0.507*	0.313	-0.575
	SE	(0.351)	(0.137)	(0.210)	(0.351)	(0.234)	(0.167)	(0.515)
Missing Math GPS	Coef.	0.611	1.647**	1.669**	0.611	0.276	0.343*	0.154
	SE	(0.355)	(0.233)	(0.293)	(0.355)	(0.143)	(0.153)	(0.268)

Missing Behavior GPA	Coef.	2.037**	-0.232	-0.129	2.037**	1.012**	1.728**	2.542**
	SE	(0.618)	(0.305)	(0.324)	(0.618)	(0.300)	(0.189)	(0.604)
Missing Absence Percent	Coef.	0.0991**	-0.265**	-0.259**	0.0991**	0.0746	-0.171	-1.171
	SE	(0.0222)	(0.0392)	(0.0472)	(0.0222)	(0.106)	(0.182)	(0.818)
Home Language is Spanish	Coef.	-0.216	0.291**	0.441**	-0.216	-0.103	0.0928*	-0.324**
	SE	(0.373)	(0.0206)	(0.0218)	(0.373)	(0.262)	(0.0399)	(0.122)

Table C2. Coefficients for Demographic Variables of Students in Grades 9 and 11 on On-Time Graduation Outcome

		All Students	Male	Female	Asian	Black	Hispanic	White
ELA Grade Point Average (GPA)	Coef.	0.146**	0.196**	0.190**	0.146**	0.229**	0.197**	0.197**
	SE	(0.0226)	(0.0179)	(0.0225)	(0.0226)	(0.0375)	(0.0186)	(0.0247)
Math Grade Point Average (GPA)	Coef.	0.0500*	0.0771**	0.0747**	0.0500*	0.118**	0.0679**	0.0999**
	SE	(0.0236)	(0.0112)	(0.0120)	(0.0236)	(0.0174)	(0.0123)	(0.0245)
Classroom Behavior GPA	Coef.	0.504**	0.513**	0.498**	0.504**	0.431**	0.522**	0.578**
	SE	(0.0431)	(0.0313)	(0.0364)	(0.0431)	(0.0414)	(0.0317)	(0.0467)
Percent of days absent	Coef.	-0.0234**	-0.0192**	-0.0170**	-0.0234**	-0.0177**	-0.0227**	-0.0164**
	SE	(0.00387)	(0.00419)	(0.00397)	(0.00387)	(0.00640)	(0.00445)	(0.00358)
Ever Retained	Coef.	-0.704**	-0.608**	-0.635**	-0.704**	-0.618**	-0.605**	-0.567**
	SE	(0.0781)	(0.0343)	(0.0514)	(0.0781)	(0.0614)	(0.0374)	(0.0682)
Special Education	Coef.	-0.676**	-0.470**	-0.443**	-0.676**	-0.500**	-0.363**	-0.626**
	SE	(0.106)	(0.0646)	(0.0765)	(0.106)	(0.0608)	(0.0794)	(0.0491)
Ever Took CAPA	Coef.	-2.877**	-3.604**	-3.582**	-2.877**	-	-3.649**	-
	SE	(0.385)	(0.296)	(0.319)	(0.385)		(0.394)	
English Learner	Coef.	-0.909**	-0.643**	-0.699**	-0.909**	-0.762**	-0.553**	-0.792**
	SE	(0.0876)	(0.0553)	(0.0693)	(0.0876)	(0.110)	(0.0422)	(0.179)
Fluent English Proficient	Coef.	0.141**	0.152**	0.147**	0.141**	0.390**	0.186**	-0.0680
	SE	(0.0519)	(0.0324)	(0.0448)	(0.0519)	(0.0870)	(0.0390)	(0.124)
Female	Coef.	-0.0241	0.0287	-0.423**	-0.0241	0.0242	0.0702**	-0.0511

	SE	(0.0421)	(0.0182)	(0.123)	(0.0421)	(0.0488)	(0.0226)	(0.0358)
Missing ELA GPA	Coef.	-0.315*	-0.499**	0.104*	-0.315*	-0.481**	-0.568**	-0.427**
	SE	(0.153)	(0.108)	(0.0473)	(0.153)	(0.154)	(0.134)	(0.128)
Missing Math GPS	Coef.	0.0115	0.0949*	0.214	0.0115	0.161*	0.0290	0.305**
	SE	(0.0825)	(0.0373)	(0.185)	(0.0825)	(0.0751)	(0.0402)	(0.0764)
Missing Behavior GPA	Coef.	0.0903	0.336*	-0.134	0.0903	0.257	0.328*	0.470*
	SE	(0.208)	(0.152)	(0.0959)	(0.208)	(0.217)	(0.167)	(0.234)
Missing Absence Percent	Coef.	0.0111	-0.172*	0.115**	0.0111	-0.142	-0.233*	-0.303
	SE	(0.0482)	(0.0809)	(0.0408)	(0.0482)	(0.120)	(0.0998)	(0.231)
Home Language is Spanish	Coef.	-0.108	0.0759*	-0.361**	-0.108	-0.350	0.0297	0.485*
	SE	(0.264)	(0.0328)	(0.0525)	(0.264)	(0.287)	(0.0395)	(0.200)

Appendix Section D. Correlations Among School Climate and Demographic Variables

Table D1. Pairwise Correlations Among School-Level Climate and Demographic Variables

	Feelings	Efficacy	Adult	Low AOD	Low Victim	Low Violence	School Size	% EL	% Parents College	% Low Income
Feelings	--									
Efficacy	0.717	--								
Adult	0.822	0.695	--							
Low AOD	0.682	0.476	0.636	--						
Low Victim	0.133	-0.031	0.100	-0.221	--					
Low Violence	0.695	0.387	0.548	0.762	0.231	--				
School Size	-0.167	-0.090	-0.277	-0.127	0.179	0.120	--			
% EL	-0.402	-0.154	-0.198	-0.416	-0.073	-0.619	-0.461	--		
% Parents College	0.581	0.364	0.373	0.501	-0.152	0.643	0.363	-0.847	--	
% Low Income	-0.604	-0.328	-0.326	-0.371	-0.064	-0.621	-0.485	0.795	-0.924	--