

School Climate and Student Learning

**An analysis of the relationship between school climate, student achievement,
and other contributing factors**

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Section 1: Introduction

What is School Climate?

The National School Climate Council defines “school climate” as “the norms, values, and expectations that support people feeling socially, emotionally, and physically safe” (National School Climate Council 2013). In a school with a positive school climate, students, families, and teachers collaborate to “develop, live, and contribute to a shared school vision” and to realize that vision (Thapa, Cohen, Guffey, D’Alessandro 2013).

The Safe and Supportive Schools Grant

In 2010, the US Department of Education awarded the Tennessee Department of Education (TDOE) \$3.3 million as part of the Safe and Supportive Schools grant (Dept. of Ed 2010). The grant asked states to develop a survey instrument to measure school climate. Additionally, the grant sought to provide schools with funds to “create and support safe and drug-free learning environments and to increase academic success for students in these high-risk schools” (Dept. of Ed 2010).

The Center for School Climate within TDOE is the primary manager of the Safe and Supportive Schools grant. Its goal is to “assist Tennessee schools in their efforts to provide safe and supportive learning environments for all students” (TDOE 2013). The underlying belief of this office is that school climate is an important component of student learning and that effectively measuring school climate will be important in improving achievement among Tennessee’s students.

To better measure student perceptions of school climate, TDOE designed its own survey in 2010 and began administering it in 2011-12. While developing the survey, TDOE involved several experts, parents, students, and educators in order to develop constructs and build a valid instrument. In 2012-13 TDOE administered the survey to 114 schools in 27 districts. The survey comprises eight constructs and eighteen sub-constructs that encompass many components of school climate such as Physical Safety, school connectedness, and safe and supportive relationships. For a full breakdown of the constructs and structure, see Appendix A. Appendix B details the questions and constructs more specifically.

Participating schools use the survey results to inform how to best spend the grant money and improve school climate. However, TDOE has expressed a belief that not all climate constructs are equal and that some may be more important to supporting student learning than others. To be able to best support schools as they administer programs designed to support school climate, TDOE asked me to use the survey to answer two questions:

- (1) What student and school level factors predict student perceptions of school climate?
- (2) Do perceptions of school climate predict student achievement outcomes for high school students in Tennessee?

Section 2: Literature Review

Part One: What Predicts School Climate?

School-Level Characteristics

School size is one characteristic that contributes to student perceptions of school climate. The Small Schools Initiative was built on the premise that in a smaller school, the sense of community is greater and students feel more supported by teachers and peers (Small Schools Coalition web). However, the results of the initiative were decidedly negative. However, the academic literature on school size and student outcomes reveals mixed results from small schools (Paul 2010; Nguyen 2004).

In addition to school size, Finn and Voelkl found that the racial and ethnic composition of a school population has been shown to affect the engagement levels of students within the school (Finn & Voelkl 1993). Additionally, Finn found that the regulatory environment such as the rigidity of school procedures and the nature of the discipline system were shown to affect student engagement and relationships (Finn & Voelkl 1993).

Student-Level Characteristics

Every student has a unique relationship with his/her school that contributes to perceptions of school climate. Thus, as Keefe writes, “personalization is the key to making schools exciting and productive places of learning” (Keefe 1986). Understanding the issues and needs that individual students and groups of students might face is important. The issues students face will differ based on academic experiences, demographic characteristics, and school characteristics. Individual ability, family background, self-concept, attitudes toward school, aspirations, and creativity may all be important student-level inputs in measuring school climate (Anderson 1982).

Race is a significant factor in explaining variation in student perceptions of school climate and has been considered “important for racial minority and poor students” (Booker, 2006; Haynes, Emmons, & Ben-Avie, 1997). One study of fifth grade students using multi-level modeling found that African-American students tended to rate their schools consistently lower on climate than white peers (Mitchell, Bradshaw, and Leaf, 2010).

Among students, girls tend to report greater consistency and fairness in school rules (Way, Reddy, & Rhodes 2007). Additionally, Watkins and Aber found that minority, low-income, and female students perceived climate more negatively than their white, non-poor, and male peers (Watkins & Aber, 2009).

Part 2: Does School Climate Predict Student Achievement?

Studies of various constructs of school climate found that climate influences academic outcomes on both the student and school level.

Bullying and Student Achievement

Elementary schools with a successful bullying prevention effort experienced profound improvements in student achievement test scores (Fonagy et.al. 2005). One study of more than

27,000 teenage boys in Canada found that bullying was negatively related to individual student achievement using the Program for International Student Assessment (PISA). This study showed that students who reported being at a school where bullying was a problem had lower individual math scores by sixteen points and reading scores by thirteen points (Konishi, Hymel, Zumbom, Li 2010). Note that these findings refer to school level reports, rather than student level perceptions, of bullying.

Supportive Relationships and Student Achievement

Both teacher relationships and peer relationships also affect student achievement outcomes. Positive teacher relationships have strong, significant, and positive impacts on student achievement (Konishi, Hymel, Zumbom and Li 2010). Poor student-teacher relationships as early as kindergarten have been linked to behavioral and academic problems in later grades (Hamre and Pianta 2001). Positive peer relationships were shown to encourage more cooperative learning environments and were related to more positive student achievement outcomes (Roseth, Johnson, and Johnson 2008).

Student Engagement and Student Achievement

The way teachers and schools engage students relates positively to student achievement. When students actively participate in learning there is a greater potential for improved academic achievement (Ladd, Birch, and Buhs, 1999; Voelkl, 1995). Further, teachers who consistently enforce rules and reinforce that students must demonstrate respect for one another are more likely to have students with higher student achievement (Ennis, 1998).

Other Academic Benefits of a Positive School Climate

School climate also positively relates to other academic outcomes that are not test score based. Positive school climate corresponded with lower student absenteeism in middle and high school in multiple studies (deJung and Duckworth, 1986; Gottfredson, 1989; Purkey and Smith, 1983; Reid, 1982; Rumberger, 1987; Sommer, 1985). Drop-out prevention was one major driver of the US Department of Education's investment in the Safe and Supportive Schools grant. This followed a report from the Institute for Educational Sciences which cited improving school climate as a sound strategy for dropout prevention (Dynarski et.al. 2008).

However, the literature often treats school climate as a school-level phenomenon. This research adds to the literature by examining how different students within a school perceive school climate and tries to understand those differences as they relate to achievement outcomes.

Section 3: Analytical Background

To perform the analysis, I use survey data from the Tennessee Department of Education's 2012 administration of the survey. After removing incomplete or invalid survey responses, there were more than 60,000 survey responses. Student achievement data came from the 2012 and 2013 administrations of the Tennessee Comprehensive Assessment Program. Appendices A-D provide an overview of the survey instrument and evaluate the survey for reliability and validity.

Measures

In order to complete both parts of the analysis I used the following variables as measures of student demographics, student achievement, and school level characteristics:

- Academic Achievement: Student achievement was defined as the standardized value¹ of a students' most recent performance on an English assessment. That is, if there were multiple test scores for one student, the most recent and highest class level test score was used for the analysis.² The rationale for this approach was twofold. First, there is more overlap and consistency in English curriculum from year to year than in Math or Science. That is, in each year English I through IV students identify theme and symbolism, but in increasingly difficult texts and with increasingly higher expectations. In math and science, however, the skills change entirely. It is possible, for example, to do well in algebra but to have limited understanding of the concepts in Geometry. Thus, English is more comparable across grade levels and was therefore more appropriate. Second, the proportion of students matched to any one individual test was low. Thus, to reduce potential bias and strengthen the statistical power, I used the most recent English test score (of any English class) as opposed to a specific English course.
- School Climate: School climate is a student level measure and refers to students' relative perceptions of school climate. It is measured by the survey (described in Section 1). Constructs of school climate were measured by a simple average of each question which comprised the construct (as defined by the survey writers). Overall school climate was an average of all 85 questions in the survey whereas specific constructs were averages of only the questions survey writers indicated comprised that construct.
- School Level Characteristics: In some models I control for school level demographic information. This information was collected from TDOE's public data for 2012-2013 and includes school size as measured by Average Daily Membership, racial composition measured by the percent of students who are Hispanic and black in the school, and the percent of students on free or reduced lunch in the school. I also use the percent of students who scored proficient or advanced on the Tennessee Comprehensive Assessment Program at the school.
- Matched Student: a "Matched Student" is one whose student ID number reported on the survey was able to be matched with a student ID number on the assessments. An "unmatched student" is one whose student ID was not matched to any tests in the state. This may be because a student moved to Tennessee and thus did not have a recent test for matching, a student misreported his or her ID number, or a student did not know his or her student ID number.
- Minority and non-minority schools: Schools comprised of more than 50% Black, Hispanic, or Native American students are labeled "Minority Schools." All others are "non-minority" schools.
- High, Average, and Low Achievers: High Achievers are students scoring higher than one standard deviation above the mean (roughly the top one-third of matched survey-takers).

¹ Standardized test scores refers to a process by which all test scores are normed around a mean of zero and standard deviation of one. In education policy research, this is a convention used and makes interpretation easier. On this data set one standard deviation is equal to roughly 50 points on the scaled score.

² For example, if there were data available for one student on English 2 in 2012 and English 3 in 2013, the English 3 score was used.

Average achievers include students who score between one standard deviation above or below the mean. Low achievers are students who score more than one standard deviation below the mean (the bottom third of matched survey-takers).

- **Majority Student:** This indicator variable equals one when a student’s race matched the racial majority at his or her school.
- **Racially Advantaged Student:** this indicator variable equals one when a student reports belonging to a historically academically advantaged racial group such as White or Asian/Pacific Islander. Disadvantaged groups included African American, Hispanic, and Native American Students.

Survey Representativeness and Generalizability of the Findings

Prior to administering the survey, TDOE selected schools to participate. Selection was based on need, representativeness of the state, and other factors that may limit ability to participate. The resulting sample contained 27 districts comprised of 114 schools that signed memorandums of agreement to participate and received an addition \$20 per pupil. In total, the selected schools had 101,855 students enrolled during the 2012-13 academic year. Of these, 69,480 students began the survey. Among the completed surveys, survey analysts removed those that were incomplete or invalid. Survey analysts defined “invalid” as any survey where respondents answered straight down with one answer, answered in a pattern, or where completion occurred implausibly fast. This left 58,985 surveys for analysis. Among the 58,985 surveys left, only 39,544 were able to be matched to student test scores.

Before interpreting the results, it is important to understand the extent to which one can generalize the findings. Figure 1 demonstrates visually the relationship between the statewide population and the survey sample. There are several layers of generalizing to be careful about.

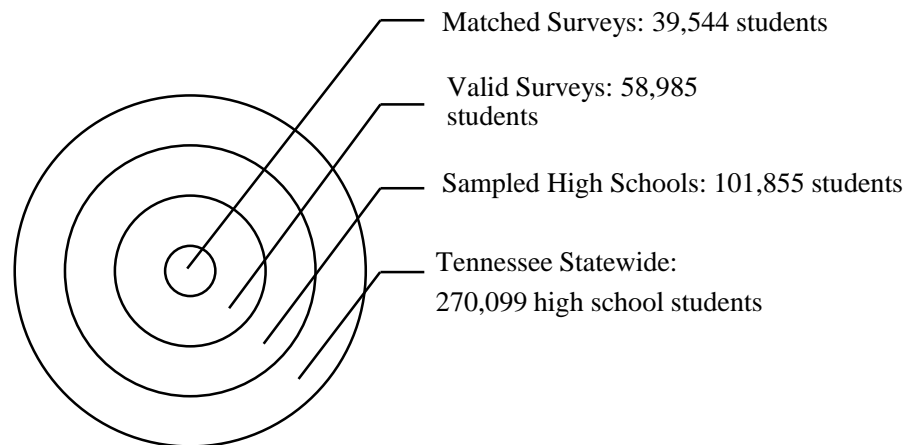


Figure 1: Limitations of Survey Generalizability

First, generalizing from the matched surveys to the complete sample of surveys (including those not able to be matched to student outcomes) is problematic because matching was seemingly un-random. Ability to match a student’s survey to a test score was significantly related to race and gender as Table 1 demonstrates. White students were less likely to be

matched while black and Hispanic students were more likely to be matched. Females were more likely to be matched and males were less likely to be matched.

There are several places where matching could go wrong. First, at the school level, some administrators were unclear what the student ID was. One school, for example, had students report social security numbers so the entire school was not matched. On the student level, students may have misreported their ID numbers due to random error, because they did not know the student ID number, or because they failed to follow directions. These reasons have varied implications for interpretation however it is impossible to know what really happened. Thus, I will be cautious generalizing beyond those who took the survey and reported the correct ID number.

The inability to match student surveys to achievement outcomes is problematic for this analysis. Thus, TDOE should be careful in the future to ensure that schools and students correctly fill out the identification information on the surveys.

Table 1: Demographic Differences between Matched and Unmatched Surveys

	Matched Surveys		Unmatched Surveys		t-test
	Mean	Standard Deviation	Mean	Standard Deviation	
White (%)	69.19	0.462	74.88	0.749	-10.15***
Black (%)	21.05	0.408	16.44	0.164	15.1635***
Hispanic (%)	6.19	0.241	3.95	0.039	12.8769***
Asian (%)	2.32	0.151	2.09	0.021	0.2114
Native American (%)	0.85	0.917	0.88	0.094	-0.0455
Mixed Race (%)	0.40	0.063	1.75	0.131	-1.69*
Male (%)	49.53	0.499	50.34	0.500	-1.86*
Female (%)	50.47	0.499	49.7	0.500	2.03**

*** p<0.01, ** p<0.05, * p<0.1

Representativeness of the Survey

Students who took the survey and were matched to student achievement scores were 69% white, 21% black, 6% Hispanic, 2% Asian, and less than 1% Native American. Fifty-one percent of the matched survey respondents were female and 49% were male. The differences between the demographics of the matched survey sample and the population are statistically significant.

However, there were 19,441 survey takers with missing achievement data. Missing students were 49.6% female and 50.4% male. Seventy-five percent of missing students were white, 16% were African American, 4% Hispanic, 2% Asian, and less than 1% Native American. Among missing students 27% were in 9th grade, 25% in 10th grade, 24% in 11th grade and 24% in 12th grade. 45% of students with missing achievement scores attend rural schools and 36% attend urban schools.

For a full breakdown of the representativeness of the survey, see Appendix E.

Section 4: Analysis

Because the research questions are two-fold, this research breaks the analysis into two sections. First, I use multiple regression approach to estimate what student- and school-level characteristics predict student perceptions of school climate. Second, I will estimate whether perceptions of specific school climate constructs predict student achievement outcomes for high school students in Tennessee.

Part 1: What Predicts School Climate?

Analytical Approach

In general, I begin with basic means and correlations between academic achievement and other demographic characteristics and school climate and progress to more complex statistical models. The primary tool I use is Ordinary Least Squares regression. The first regression I specify is as follows:

$$CLIMATE_i = \beta_0 + \beta_1 X_i + \beta_2 Ach_i + \varepsilon$$

where CLIMATE indicates either the average of all questions or the average of one of the climate constructs and X_i indicates a vector of student characteristics for student i including race, grade-level, and gender. Ach_i indicates student i 's most recent English test score, standardized with mean zero, standard deviation one. The errors, ε , are robust and clustered at the district level.

Second I use the literature-based finding that school characteristics affect perceptions of school climate and add school-level characteristics to the model:

$$CLIMATE_i = \beta_0 + \beta_1 X_i + \beta_2 Ach_i + \beta_3 X_j + \varepsilon$$

X_j is a vector of school characteristics for the school j that student i attends. These characteristics include percent of students on free/reduced lunch, percent of students advanced/proficient on English II TCAP, locality type (rural, urban, suburban), and racial composition of the school.

Finally, I use school-level fixed effects to isolate the variation of student perceptions of school climate within schools. This is an improvement over the first model because school characteristics that influence school climate will be largely unobserved and fixed effects help account for stable, unobserved variation between schools. The model is as follows:

$$CLIMATE_i = \beta_0 + \beta_1 X_i + \beta_2 Ach_i + \lambda_j + \varepsilon$$

Where λ represents school-level fixed effects described above. This is the most restrictive and conservative model.

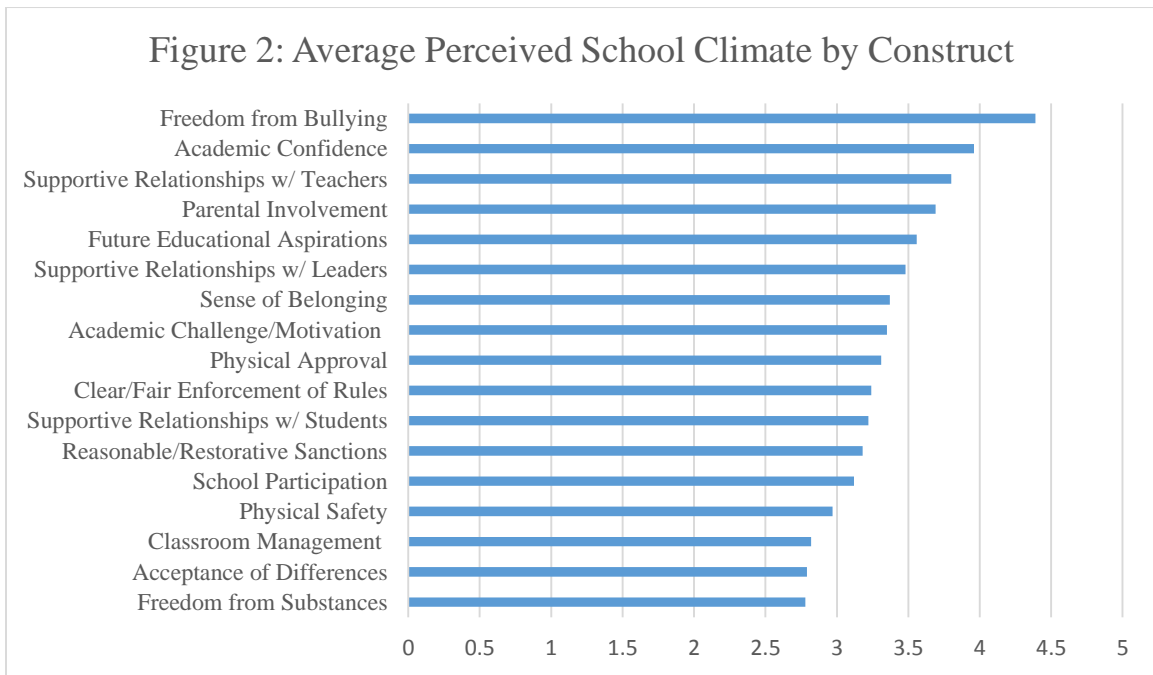
For each model, I clustered standard errors at the district level and specified robust (heteroskedastic) errors. This is because district level policies (such as professional development) may mean that the standard errors are not independent and uniformly distributed as OLS

regression requires. These two adjustments account for these problems and make the models more conservative.

Analysis: Overall School Climate

Overall, the average school climate composite was 3.42. Given that 3 indicated a neutral opinion on the survey questions, this indicates that students view their school’s climates moderately positively.

Figure 2 shows the average responses by construct. The most positive constructs are Freedom from Bullying, Academic Confidence, and Supportive Relationships with Teachers. The lowest constructs on average are Classroom Management, Freedom from Substances, and Acceptance of Differences.



I hypothesized that student demographic information such as race and gender would most strongly predict overall perceptions of school climate. Table 2 shows the results of three models testing this theory. The table reveals that the most significant relationships were between gender, grade level, and student achievement.³

Males view school climate substantially more positively than their female counterparts across all three models (figure 3). Additionally, 10th and 11th grade students viewed school climate most negatively (figure 4).

Student achievement positively predicts student perceptions of school climate in the most basic model. However, after adding school level characteristics and school-level fixed effects, the relationship disappears. This indicates that school level factors explain most of the variation in student perceptions of school climate.

³ The results are in terms of standard deviations, a convention used in education policy research. In the literature, an effect size of 7% of a standard deviation is generally viewed as substantial.

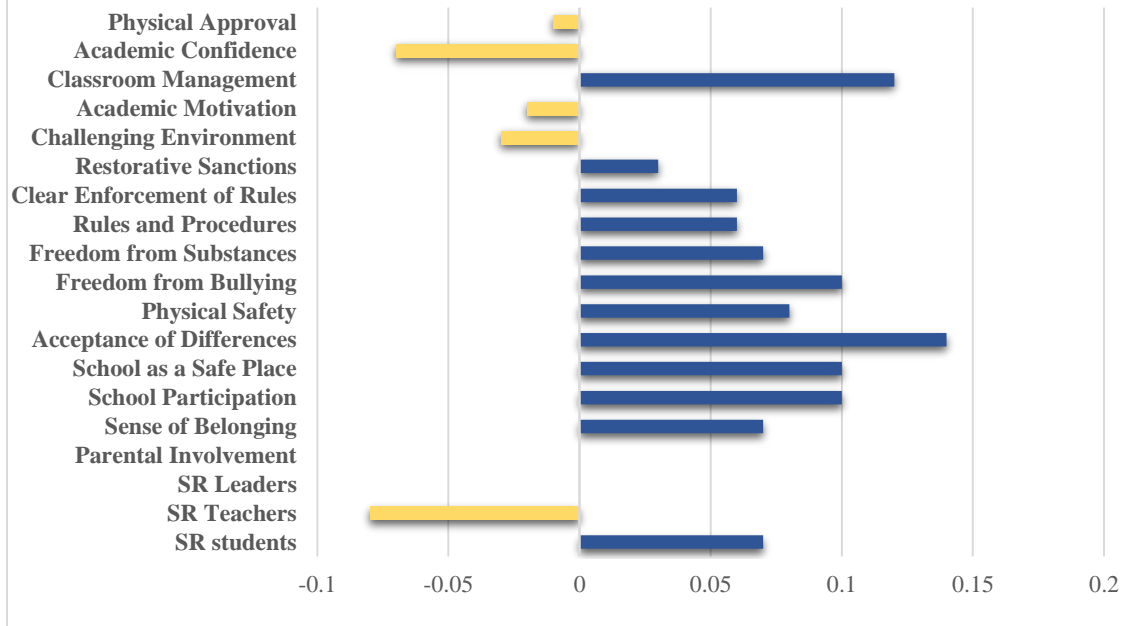
Table 2: Student- and School-Level Characteristics and Perceptions of School Climate

VARIABLES	(1) Overall School Climate	(2) Overall School Climate	(3) Overall School Climate
Male	0.102*** (0.0181)	0.0988*** (0.0188)	0.0994*** (0.0206)
10th Grade	-0.191*** (0.0346)	-0.196*** (0.0316)	-0.179*** (0.0271)
11th Grade	-0.209*** (0.0360)	-0.209*** (0.0322)	-0.200*** (0.0313)
12th grade	-0.124*** (0.0350)	-0.126*** (0.0299)	-0.118*** (0.0277)
Black	-0.0342 (0.0402)	0.0987** (0.0366)	0.0865** (0.0313)
Hispanic	-0.0428 (0.0355)	0.0580* (0.0324)	0.0498 (0.0316)
Asian	0.0249 (0.0474)	0.0503 (0.0569)	0.0319 (0.0512)
Native American	-0.341*** (0.0543)	-0.316*** (0.0592)	-0.304*** (0.0579)
Mixed/Multi-Race	-0.0248 (0.0662)	-0.1195 (0.0940)	-0.0804 (0.0627)
Student Achievement	0.0565*** (0.0178)	0.02460* (0.0141)	0.0141 (0.0165)
Urban School		0.0944** (0.0467)	
Rural School		0.0620** (0.0304)	
School % FRL		-0.2696 (0.2278)	
School % Black		-0.1705 (0.1259)	
School % Hispanic		0.7290 (0.5921)	
School ADM (hundreds of students)		-0.0358*** (.0088)	
School % Proficient or Advanced on English 2 Test		0.7691*** (0.2043)	
Constant	0.0593 (0.0397)	0.2928 (0.2246)	0.0226 (0.0286)
School Level Fixed Effects?	No	No	Yes
Observations	38,634	38,337	38,634
R-squared	0.015	0.046	0.084

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Figure 3: Difference between Male and Female Perceptions of School Climate

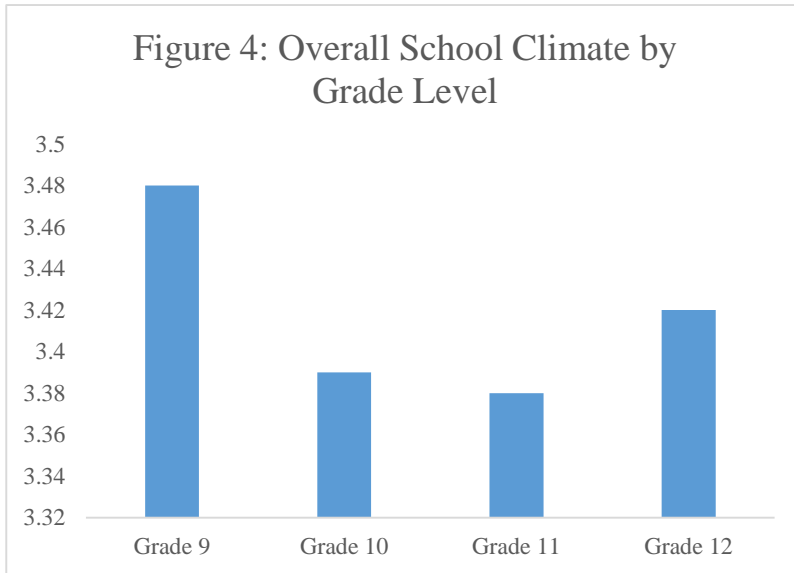


Gender consistently and substantially predicts perceptions of school climate. Males report roughly 10% of a standard deviation higher perceptions of overall school climate than female counterparts. This is likely driven by specific sub-constructs and it is important to know on which components specifically females report feeling less positively. Figure 3 shows the difference between male and female school climate construct averages. Bars on the right are constructs where males reported more positively and bars on the left are constructs that females reported on more positively. From the chart, it seems that females consistently report feeling less positively about constructs having to do with student relationships. The difference between males and females was greatest on the constructs Acceptance of Differences, Freedom from Bullying and Harassment, Supportive Relationships with Students, and Classroom Management. However, females lead their male counterparts on the constructs Academic Confidence and Supportive Relationships with Teachers.

This may suggest that female students feel better about school climate insofar as it supports learning, but that males feel more positively about peer interactions. This could provide valuable insight for TDOE and the participating school districts as they consider how to best target students according to need. For example, anti-bullying campaigns might be best targeted toward female students whereas programs generating teacher mentorships might be best targeted toward male students.

Figure 4 shows the average school climate by grade level. Consistent with Table 2, this shows that students in the middle grades of high school feel somewhat less positively about overall school climate at their schools. Anecdotally, this is consistent with high school experiences – the tenth grade year has been characterized as the “sophomore slump” and

eleventh grade is a stressful year with the greatest number of state tests, college entrance exams, identification of those who will need remediation to graduate on time, and other stressful events.



Analysis: Supportive Relationships with Teachers

In addition to examining what factors contribute to overall perceptions of school climate, I generated hypotheses about specific constructs.

I created two hypotheses related to Supportive Relationships with Teachers. I first hypothesized that females and high achievers would report feeling more supported by teachers across all schools. Second, I hypothesized that minority students would report feeling more supported by teachers in schools with a majority of minority students. Table 3 and Table 4 present my findings for these hypotheses.

Table 3 reveals two main findings. First, females report feeling 8.6% of a standard deviation more positively about ‘feeling supported by teachers’ than their male counterparts. Second, Low Achievers viewed relationships with teachers substantially more negatively than their high or average achieving peers (34% of a standard deviation). This is not surprising and supports the initial hypotheses.

Table 4 presents findings for the second hypothesis. Minorities report feeling overall less supported by teachers. This effect is particularly strong and significant in predominantly white schools. However, in schools where minority students make up the majority of the student body, the effect is positive but largely insignificant.

Table 3: The Relationship between Gender/Achievement and Supportive Teacher Relationships

VARIABLES	(1) Supportive Relationships with Teachers	(2) Supportive Relationships with Teachers	(3) Supportive Relationships with Teachers
Female	0.0864*** (0.0142)	0.0851*** (0.0143)	0.0835*** (0.01498)
Average Achiever	-0.223*** (0.0199)	-0.2193*** (0.0212)	-0.2195*** (0.0204)
Low Achiever	-0.3478*** (0.0266)	-0.3466*** (0.0261)	-0.3390** (0.0279)
Student Level Covariate	Yes	Yes	Yes
School Level Covariates	No	Yes	No
School Level Fixed Effects	No	No	Yes
Constant	0.1921*** (0.1247)	0.3963*** (0.125)	0.1773*** (0.0287)
Observations	38,630	38,333	38,630
R-squared	0.022	0.026	0.036

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4: The Relationship between Racial Groups and Supportive Teacher Relationships

	Panel A: All Schools			Panel B: Minority Schools			Panel C: Non-Minority Schools		
	(1) Supportive Relationships with Teachers	(2) Supportive Relationships with Teachers	(3) Supportive Relationships with Teachers	(1) Supportive Relationships with Teachers	(2) Supportive Relationships with Teachers	(3) Supportive Relationships with Teachers	(1) Supportive Relationships with Teachers	(2) Supportive Relationships with Teachers	(3) Supportive Relationships with Teachers
Minority Students	-0.0350** (0.0156)	-0.0269 (0.0171)	-0.0314* (0.0163)	0.0438** (0.0124)	0.0195 (0.0114)	0.01618 (0.0107)	-0.0558** (0.0224)	-0.0394* (0.0211)	-0.0430** (0.0194)
Student-Level Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
School-Level Covariates	No	Yes	No	No	Yes	No	No	Yes	No
School-Level Fixed Effects	No	No	Yes	No	No	Yes	No	No	Yes
Constant	-0.0398** (0.0188)	0.180 (0.130)	-0.0456*** (0.0161)	-0.0585 (0.0510)	-0.203 (0.1163)	-0.0657 (0.0410)	-0.0479** (0.0209)	0.1298 (0.1403)	-0.0495** (0.0202)
Observations	38,630	38,333	38,630	6,775	6,588	6,775	31,855	31,745	31,855
R-squared	0.019	0.024	0.033	0.010	0.019	0.022	0.021	0.026	0.035

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Analysis: Acceptance of Differences

I hypothesized that students in the racial majority will report that peers are more accepting of differences using in-group and out-group literature as a guide. Table 5 evaluates this hypothesis and reveals two major findings.

First, the table shows that majority students generally feel that their peers are more accepting of differences. However, the magnitude and significance of the coefficients vary across the three models indicating that school level characteristics play a role in how students feel about this construct.

The table also reveals that gender has a strong relationship with students' feeling their peers are accepting of differences. Females report feeling as though their peers are less accepting of differences by 18% of a standard deviation. The result is consistent across all specifications and significant at the 99% confidence level.

Because the coefficients varied a lot in terms of magnitude I further broke down majority student into racial subgroups. This revealed that Hispanic students view peers as slightly more accepting than other racial groups. However, the analysis reveals that gender, not race, provides the greatest distinction among students in terms of perceptions of acceptance of peers.

Table 5: The relationship between student racial groups and Acceptance of Differences

	(1) Acceptance of Differences	(2) Acceptance of Differences	(3) Acceptance of Differences
Majority Student	0.0358 (0.0447)	0.124* (0.0713)	0.0613* (0.0337)
Female	-0.1855*** (0.0260)	-0.181*** (0.0281)	-0.180*** (0.0277)
Student Covariates	Yes	Yes	Yes
School Covariates	No	Yes	No
School-Level Fixed Effects	No	No	Yes
Constant	-0.182* (0.0904)	-0.613 (0.446)	-0.215*** (0.0402)
Observations	38,614	38,317	38,614
R-squared	0.014	0.034	0.088

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Analysis: Freedom from Bullying

The literature suggests that victims of bullying tend to be vulnerable, socially isolated or with few friends, and students who have poor self-esteem (NASP web). In high schools, younger students who may be feeling socially disconnected or out of place in a new school disproportionately fit this description. Thus, I hypothesized that 9th-grade students would report feeling more bullied than their older peers.

Table 6 demonstrates that the data supports this hypothesis and reveals two major findings. First, ninth grade students report that they feel up to 8.74% of a standard deviation more negatively about bullying at their schools. Second, one of the biggest findings to emerge in this analysis was the magnitude of the differences between males' and females' feelings of being bullied. The coefficient among females indicates that female students report feeling 17% of a standard deviation more bullied than their male counterparts. While this was not a result I hypothesized, it is an important finding for TDOE due to its significance and magnitude. Further, it suggests that there are differences in perceptions of bullying or experience with bullies across genders that administrators might be able to target strategically with interventions.

Table 6: Grade-Level and Gender effects on Freedom From Bullying

VARIABLES	(1) Freedom from Bullying	(2) Freedom from Bullying	(3) Freedom from Bullying
9 th Grade	-0.0795*** (0.0202)	-0.0785*** (0.0221)	-0.0874*** (0.0225)
Female	-0.170*** (0.0143)	-0.170*** (0.0149)	-0.171*** (0.0140)
Student-Level Covariates	Yes	Yes	Yes
School-Level Covariates	No	Yes	No
School-Level Fixed Effects	No	No	Yes
Constant	0.124*** (0.0380)	0.229** (0.1194)	0.140*** (0.0130)
Observations	38,611	38,314	38,611
R-squared	0.014	0.017	0.037

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Analysis: Classroom Management

Initially, I hypothesized that student level achievement would relate positively with student perceptions of classroom management. Panel A of Table 7 provides evidence that supports this hypothesis. However, the questions ask about whether disruptions at the classroom or school level affect a students' learning. Thus, I adjusted the model to reflect the relative

achievement level of the schools. A “High Achieving School” was a school where more than 80% of students scored proficient or advanced on the English II TCAP assessment in 2013. Conversely, a “Low Achieving School” is one where 30% or fewer students scored proficient or advanced on the English II TCAP.

Panel B shows that students attending high achieving schools consistently and significantly report more positive perceptions of classroom management. However, the trend for low-achieving schools disappears after adding school-level demographic information. This may indicate that some other factor, such as racial composition of the school, is driving the negative effect for low-achieving schools. Once I control for the school level characteristics, the relationships change both in terms of magnitude among high achieving schools and in terms of direction among low-achieving schools.

Table 7: The Effect of Student and School Achievement Level on Perceptions of Classroom Management

	Panel A: Student Achievement			Panel B: School Achievement		
	(1) Classroom Management	(2) Classroom Management	(3) Classroom Management		(1) Classroom Management	(2) Classroom Management
High Achiever	0.153*** (0.0392)	0.1072*** (0.0285)	0.0815*** (0.0299)	High Achieving School	0.162*** (0.0587)	0.140*** (0.0357)
Low Achiever	-0.0915*** (0.0282)	-0.0487 (0.0358)	-0.0478 (0.03478)	Low Achieving School	-0.228*** (0.0177)	0.0820 (0.0522)
Student-Level Covariates	Yes	Yes	Yes	Student-Level Covariates	Yes	Yes
School-Level Covariates	No	Yes	No	School-Level Covariates	No	Yes
School-Level Fixed Effects	No	No	Yes	School-Level Fixed Effects	No	No
Observations	38,588	38,292	38,588		38,588	38,397
R-squared	0.009	0.025	0.046		0.016	0.025

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Analysis: Academic Confidence

I hypothesized that high achieving students are more likely to express high levels of academic confidence. Table 8 displays the results.

Table 8 illustrates four major findings of interest. First, as expected, achievement is positively and significantly related to student reports of academic confidence. The effect sizes range from 10-13% of a standard deviation and are significant across all models and specifications. Second, with low-achievers as a comparison group, high achievers and average

achievers report feeling significantly more confident. F-Tests reveal that average achievers' Academic Confidence is significantly different from high achievers' confidence. Third, consistent with the findings from gender in the overall climate analysis, females report higher levels of Academic Confidence than their male counterparts. The coefficient is consistent in both magnitude and significance. Finally, there were interesting findings regarding student race and perceptions of Academic Confidence. I had hypothesized that students from traditionally disadvantaged subgroups such as Black, Hispanic, and Native American students would have lower levels of Academic Confidence. Table 8 disputes this hypothesis in part. Black and Hispanic students report feeling more confident than their white peers when you control for student and school level characteristics. However, Native Americans consistently report feeling less confident than their white peers. These findings are interesting because both groups are traditionally disadvantaged and perform significantly lower on standardized assessments.

Table 8: Achievement and Academic Confidence

VARIABLES	(1) Academic Confidence	(2) Academic Confidence	(3) Academic Confidence	(4) Academic Confidence	(5) Academic Confidence	(6) Academic Confidence
Academic Achievement	0.129*** (0.013)	0.111*** (0.0156)	0.105*** (0.0171)			
High Achievers				0.476*** (0.0548)	0.404*** (0.0377)	0.381*** (0.0397)
Average Achievers				0.1646*** (0.0189)	0.139*** (0.0203)	0.129*** (0.0224)
Female	0.0868*** (0.0179)	0.0858*** (0.0180)	0.0877*** (0.0192)	0.0971*** (0.01)	0.0949*** (0.0193)	0.0963*** (0.0205)
Black	0.0892*** (0.0260)	0.126*** (0.0266)	0.120*** (0.0242)	0.0600** (0.0252)	0.110*** (0.0305)	0.104*** (0.0287)
Hispanic	0.0363 (0.0323)	0.0832*** (0.0253)	0.0805*** (0.0271)	0.0169 (0.0301)	0.0704*** (0.0247)	0.0679** (0.0262)
Native American	-0.285*** (0.0366)	-0.282*** (0.0420)	-0.267*** (0.0414)	-0.289*** (0.0361)	-0.283*** (0.0425)	-0.269*** (0.0422)
Student Covariates	Yes	Yes	Yes	Yes	Yes	Yes
School Covariates	No	Yes	No	No	Yes	No
School Level Fixed Effects	No	No	Yes	No	No	Yes
Constant	-0.108*** (0.0196)	0.113 (0.193)	-0.116*** (0.0121)	-0.301*** (0.0383)	-0.067 (0.2066)	-0.270*** (0.0213)
Observations	38,627	38,330	38,627	38,627	38,330	38,627
R-squared	0.031	0.043	0.058	0.028	0.041	0.057

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Part 2: Does School Climate Predict Student Achievement?

Analytical Approach

In addition to analyzing what student and school-level characteristics predict perceptions of school climate, I also sought to understand if student perceptions of school climate predict student achievement.

In order to test whether school climate affects student achievement, I began with a basic regression model and gradually added restrictions and specifications. The additions were in two phases: first I start with the broadest measure of School Climate (overall average); then I move to the slightly broader categories of Engagement, Safety, and Environment; and finally I estimate the models with the most specific constructs and sub-constructs.

The first, basic model I specify is a basic multi-variable regression:

$$ACH_i = \beta_0 + \beta_1 CLIMATE_i + \beta_2 X_i + \varepsilon$$

where ACH_i refers to the standardized achievement level of student i , $CLIMATE_i$ refers to student i 's responses to the school climate survey at the overall, categorical, or construct level, X_i again refers to demographic characteristics of student i , and the errors, ε , are specified to be robust and clustered at the district level.

Next, I add school level covariates. This allows me to condition on environmental factors that likely influence the outcome. The model is as follows:

$$ACH_i = \beta_0 + \beta_1 CLIMATE_i + \beta_2 X_i + \beta_3 X_j + \varepsilon$$

where X_j refers to a set of school level characteristics. These variables include measures of racial composition, socioeconomic conditions, academic achievement of the school, and school size for school j .

Finally, because achievement may vary relative to a particular school's conditions, I use a fixed effects model. This allows me to account for unobserved variation within schools. The model is:

$$ACH_i = \beta_0 + \beta_1 CLIMATE_i + \beta_2 X_i + \lambda_j + \varepsilon$$

Analysis

Given the vast literature on achievement gaps, I hypothesize that race will be a strong predictor of student achievement. I also hypothesize that specific school climate constructs, specifically those relating to academic engagement (such as Supportive Relationships with Teachers, Academic Confidence, and Academic Motivation) will have positive and consistent relationships with student achievement. I present the results in Table 6.

The relationship between overall school climate and student achievement is positive but inconsistently significant, as Panel A shows. Panel B demonstrates that this is in part because the way students perceive the categories of school climate (engagement, safety, and environment), vary in how they relate with student achievement. While students reporting higher levels of

engagement is a consistently positive predictor of student achievement, students with positive perceptions of the learning environment consistently have lower test scores. To understand why this may be, I broke down the categories further into the more specific constructs.

The analysis of how perceptions of specific climate constructs relate to student achievement reveals conflicting results as Panel C shows.⁴ The largest effect sizes were generally positive. Academic Confidence related most substantially to student achievement. Students who reported higher levels of Academic Confidence were students who performed 24% to 28% of a standard deviation (SD) higher on standardized tests. Relatedly, Future Educational Aspirations was associated with 14.5% SD higher test scores. Supportive relationships with Teachers (13.6% SD), School Participation (10% SD), Acceptance of Differences (5.5% SD), Freedom from Bullying (5.9% SD), and Classroom Management (3.5% SD) also positively relate to student achievement.

However, students who report feeling more positively about their levels of Parental Involvement, Sense of Belonging, Physical Safety, Clear/Fair Enforcement of Rules, Reasonable/Restorative Sanctions, and Academic Motivation perform significantly lower on standardized tests. While the effect sizes of these negative relationships were not as large, there are as many negative coefficients as positive coefficients. Reporting higher on questions related to Sense of Belonging was associated with a 12-15% SD lower test scores and Freedom from Substances was associated with test scores that were 12-14% SD lower (the largest negative effect sizes). The other variables had varying effect sizes ranging from -3 to -9% SD.⁵

The surprisingly negative relationships indicate that there is likely a source of bias. For example, there may be some omitted variable from the model that is driving the negative relationship. Or there may be issues with student interpretation of the questions. In the future, TDOE might use multiple years of data to better evaluate whether this is a consistent phenomenon.

In sum there are two main findings: first, school climate matters for student achievement. Second, these relationships are not always as expected. Thus, the analysis indicates that we should not treat all components of school climate the same. The constructs with the largest effect sizes on student achievement were Future Educational Aspirations, Academic Confidence, and Supportive Relationships with Teachers, all of which positively relate to student achievement outcomes. However, Freedom from Substances and Sense of Belonging also have relatively large effect sizes and negatively relate to student achievement.

⁴ In the discussion of Panel C I evaluate effect sizes. All of the findings listed are statistically significant, however with a large sample, statistical significance is not always practically meaningful. Effect sizes help differentiate between findings that are statistically significant and those that are practically meaningful.

⁵ To be sure the relationships are not being affected by collinearity, I used Variance Inflation Factor. This test revealed that the constructs are not problematic insofar as there are not issues with collinearity. However, that still does not provide insight regarding the negative relationships with school climate constructs and achievement outcomes.

Table 9: The effect of school climate on student achievement

Panel A: Overall School Climate			
VARIABLES	(1) Student Achievement	(2) Student Achievement	(3) Student Achievement
Overall	0.111*** (0.0357)	0.0460* (0.0252)	0.0267 (0.0308)
Student Covariates	Yes	Yes	Yes
School Covariates	No	Yes	No
School Level Fixed Effects	No	No	Yes
Constant	-0.218 (0.145)	-0.656* (0.326)	0.0595 (0.0798)
Observations	38,634	38,337	38,634
R-squared	0.087	0.156	0.172

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Panel B: Climate Categories			
VARIABLES	(1) Student Achievement	(2) Student Achievement	(3) Student Achievement
Engagement	0.315*** (0.0264)	0.300*** (0.0286)	0.294*** (0.0269)
Safety	0.0625* (0.0323)	0.0248* (0.0133)	0.00833 (0.0136)
Environment	-0.262*** (0.0327)	-0.273*** (0.0216)	-0.273*** (0.0192)
Student Covariates	Yes	Yes	Yes
School Covariates	No	Yes	No
School Level Fixed Effects	No	No	Yes
Constant	-0.205 (0.143)	-0.812** (0.346)	0.0651 (0.0787)
Observation	38,623	38,326	38,623
R-Squared	0.09	0.16	0.18

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Panel C: School Climate Constructs			
VARIABLES	(1) Student Achievement	(2) Student Achievement	(3) Student Achievement
Supportive Relationships (SR) with Students	0.0386 (0.0239)	-0.000228 (0.0161)	-0.00954 (0.0128)
SR with Teachers	0.130*** (0.0171)	0.136*** (0.0157)	0.136*** (0.0165)
SR with Leaders	0.000887 (0.0128)	0.00937 (0.0117)	0.0110 (0.00774)
Parental Involvement	-0.0501*** (0.0160)	-0.0454*** (0.0121)	-0.0433*** (0.0115)
Sense of Belonging	-0.149*** (0.0133)	-0.127*** (0.0116)	-0.125*** (0.00973)
School Participation	0.120*** (0.0123)	0.106*** (0.0170)	0.100*** (0.0178)
Acceptance of Differences	0.0497*** (0.0101)	0.0533*** (0.0115)	0.0555*** (0.0101)
Physical Safety	-0.0122 (0.0273)	-0.0309*** (0.00848)	-0.0423*** (0.0122)
Freedom from Bullying	0.0483** (0.0188)	0.0588*** (0.0140)	0.0587*** (0.0125)
Freedom from Substances	-0.140*** (0.0154)	-0.124*** (0.0125)	-0.125*** (0.0131)
Clear/Fair Enforcement of Rules	-0.0496*** (0.0165)	-0.0481*** (0.0141)	-0.0477*** (0.0145)
Reasonable/Restorative Sanctions	-0.0667*** (0.00648)	-0.0658*** (0.00844)	-0.0644*** (0.00884)
Academic Motivation	-0.126*** (0.0230)	-0.104*** (0.0163)	-0.0965*** (0.0166)
Classroom Management	0.0510*** (0.00636)	0.0357*** (0.00953)	0.0351*** (0.0109)
Academic Confidence	0.279*** (0.0184)	0.246*** (0.0110)	0.240*** (0.0117)
Approval of the Physical Building	0.0119 (0.00787)	-0.0126 (0.0115)	-0.0198 (0.0136)
Future Educational Aspirations	0.192*** (0.0116)	0.149*** (0.0122)	0.145*** (0.0103)
Student Covariates	Yes	Yes	Yes
School Covariates	No	Yes	No
School Level Fixed Effects	No	No	Yes
Constant	-1.069*** (0.102)	-1.550*** (0.343)	-0.731*** (0.112)
Observations	38,555	38,260	38,555
R-squared	0.144	0.203	0.218

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Section 5: Discussion and Conclusions

This research sought to answer two questions:

- (1) What student and school level factors predict student perceptions of school climate?
- (2) Do perceptions of school climate predict student achievement outcomes for high school students in Tennessee?

First, I found that student perceptions of school climate vary widely based on student characteristics. It is important to understand these variations in order to be able to target improvements.

Overall, males, ninth/twelfth graders, and higher achieving students had more positive perceptions of school climate than their female, tenth/eleventh grade, low-achieving peers respectively. While this broad finding is important as a starting point, it does not provide much specific guidance. After referring to the literature, I generated hypotheses around the more specific school climate constructs and uncovered several important findings.

First, males and low achievers perceive that they are less supported by their teachers (8% and 12% of a standard deviation lower respectively). Thus, TDOE should consider investing in programs that target these subgroups. Although I hypothesized that minority students would feel more supported by teachers in schools where they are the ethnic majority, the data did not support this claim. However I found that minorities in predominantly white schools feel significantly less supported by teachers but that minorities in minority schools do not feel statistically differently from white peers at minority schools.

Second, females report that they feel as though peers are less accepting of differences than their male peers. The analysis revealed that females answered 18% of a standard deviation lower on questions related to acceptance of difference. However, my hypothesis that racial group membership would predict this was untrue – there was not a statistically significant result.

As predicted, younger students feel more bullied by peers than older students. Ninth graders report experiencing bullying 8% of a standard deviation more frequently. The data and analysis also revealed that female students feel more bullied by their peers. This finding and the finding related to Acceptance of Differences and gender supports the growing body of literature which finds that the face of bullying is changing. Bullying no longer takes the form of physical violence among males, now it is often emotional and takes place via social media, texting, and verbal bullying behaviors (CDC 2013). Given the change in the nature of bullying and given that females are often the target (CDC 2013), TDOE should encourage schools to invest in bullying programs specifically geared toward this newer model of bullying which targets females.

A number of interesting patterns emerged when evaluating Academic Confidence. First, student achievement level predicts Academic Confidence. Students with high achievement outcomes report significantly higher levels of Academic Confidence than average and low achieving peers.

Additionally, Black students report having substantially higher levels of Academic Confidence than their White peers on average. Native Americans and Hispanic students have lower levels of Academic Confidence than their white peers. Given the growing achievement gap and the economic problems which result, this is a very relevant finding – especially given the relationship between reported Academic Confidence and student achievement.

To answer the second question, I found that perceptions of school climate relate to achievement outcomes, but not always as expected. After analyzing what contributes to student-level differences in perceptions of school climate, it is important to analyze and understand how these differences may predict variation in student achievement. While there is not enough evidence to assign a causal conclusion, these findings are important for TDOE to consider as they decide how to allocate funds to schools. That is, because TDOE is invested in aligning every action with its goal to improve outcomes for students, TDOE should investigate further what characteristics predict those constructs that significantly relate to improved student achievement.

Academic constructs were generally more positively related to student achievement and had the largest effect sizes. The constructs that positively relate to student achievement include Supportive Relationships with Teachers (13% of a standard deviation increase), Academic Confidence (24-28% of a standard deviation increase) and Future Educational Aspirations (14-19% of a standard deviation increase). These constructs are primarily academic in nature and support the idea that a culture of achievement is an important cultural component and may be worth investing in building. However, Academic Motivation, another academic construct, negatively relates to student achievement (-10-12% standard deviation decrease).

Constructs related to engagement with peers have varying relationships with student achievement and moderate effect sizes. For example, Freedom from Bullying and Harassment, School Participation, and Acceptance of Differences positively relate to student achievement (5.8% SD, 10% SD, and 5.5% SD respectively) whereas Sense of Belonging negatively relates to student achievement and has a larger effect size (-12.5% SD).

The constructs related to classroom environment generally negatively relate to student achievement. This finding is counter to what one might expect. Across all models, student perceptions of Clear and Fair Enforcement of Rules, and Reasonable and Restorative Sanctions negatively relate to academic outcomes (-5% and -6% SD respectively). However, perceptions of Classroom Management positively relate to student achievement (3 to 5% SD increase).

Constructs related to feelings of safety also had mixed relationships with student achievement, but the effects were smaller than the academic constructs. Physical Safety and Freedom from Substances negatively relate to student achievement (-4% and -12.5% SD respectively) while Freedom from Bullying positively relates to student achievement (5.9% SD).

Given the unexpected findings from part two of the analysis, I believe that further analysis is needed. In particular, TDOE might focus on sampling strategies and working with schools to ensure compliance. Additionally, TDOE might consider evaluating the content of the survey questions on the constructs with odd results. Further investigation will provide TDOE

with information that will enable the Office of Safe and Supportive Schools to draw the most accurate conclusions.

Limitations of the Findings

First, generalizability is a major limitation of these findings. As described before, generalizing the findings described above to the school, district, and state level is hugely problematic because of selection bias. Because we do not know why some students did not participate or misreported their numbers it is difficult to know the extent to which this is a problem. If students were not surveyed at random owing to time constraints this would not be worrisome. However, if classes of students were omitted based on certain characteristics, there could be bias – the data suggest that missingness was not random making this problematic. For example, if special education students were omitted, the survey may be biased upward because special education students are traditional victims of bullying and harassment and may have more negative perceptions of school climate than their surveyed peers. However, if the advanced classes were not surveyed, the theory that higher performing students view school climate more positively would suggest that our estimates for school climate are biased downward as these students would rate their school's climate more positively than their surveyed peers. Because we do not know what happened or why students were not given the survey, it's difficult to assess the bias of our estimates.

The second problem is causality. Throughout the academic literature there is a debate on school climate: is it possible to isolate the effect of school climate? Improvements in school climate could cause improvements in student achievement but changes in student achievement may also cause changes in how students perceive school climate. This makes it difficult to truly understand the relationship. Thus, it is inappropriate to claim that improving school climate constructs such as Academic Confidence or Supportive Relationships with Teacher will improve student performance on standardized assessments. However, the fact that there is a relationship suggests that there is reason to continue researching.

Further Research

Moving forward, TDOE should continue to use the survey instrument as it is a well-designed, valid and reliable tool. With longitudinal data TDOE can make two improvements. First, they can measure changes in school climate and compare them to student achievement trends. This will allow TDOE to understand if there is some relationship between the two or if there is some lag between changes in climate and changes in student achievement. Second, it will allow TDOE to better analyze the negative relationships between certain school climate constructs and student achievement.

Additionally, TDOE should use this tool on a carefully drawn sample in the future. Participation in the survey varied widely between schools. As a result, it is difficult to know how selection may have affected the results. The lack of uniformity in survey administration could be very problematic for the analysis. Thus, TDOE should be more rigid with the requirement to participate or follow up with schools to understand why certain students did not complete the survey.

Recommendations

Moving forward, I cautiously recommend that TDOE use the information gathered from the first part of this analysis to assist schools as they design strategies for school climate improvements. Targeted interventions for specific subgroups of students may best support improvements in school climate.

However, the fact that part two of the analysis revealed that perceptions of school climate constructs inconsistently relate to student achievement outcomes indicates a need for further research. TDOE should use the data available from multiple years of survey implementation and TCAP results to better understand if there is a causal relationship between perceived school climate and student achievement.

Given that these conclusions are not causal or generalizable to the population, TDOE should continue analysis into future years and work with schools to ensure full participation in order to mitigate these limitations.

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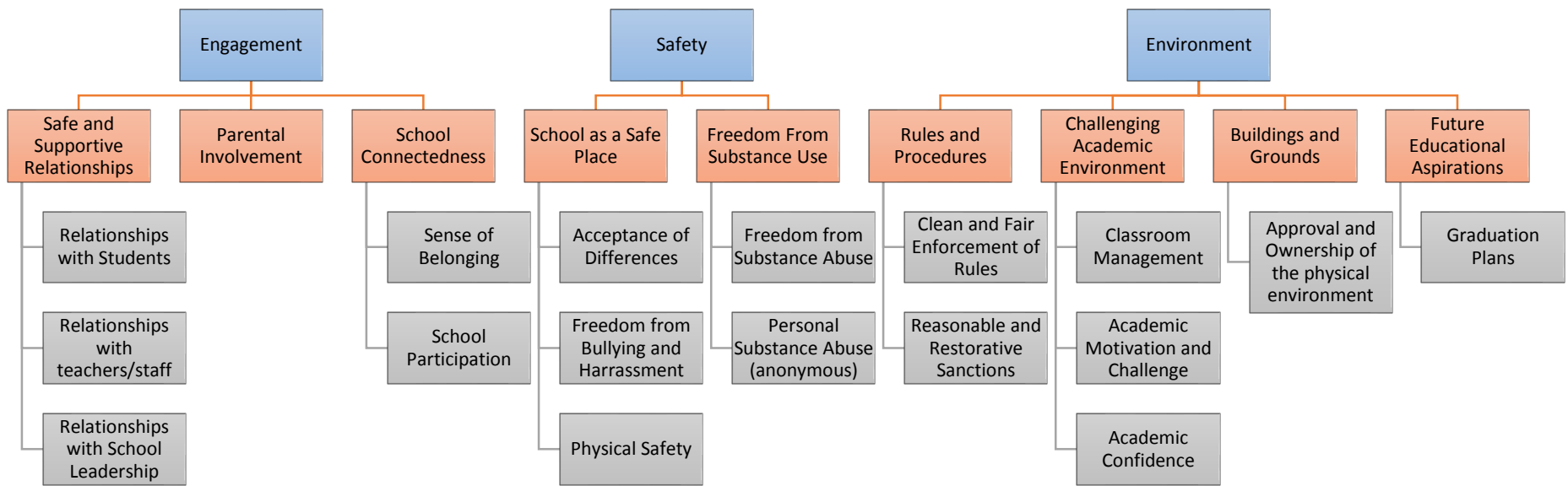
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Appendix A: Survey Structure⁶



⁶ Adapted from <https://www.safeschoolstn.org/>

Appendix B: TN School Climate Instrument: Final Dimensions, Components and Items

Dimensions	Components	Description of Construct	Item #	Specific Items	
Engagement	Safe and Supportive Relationships	Supportive Relationships – Students Students feel safe and supported in a peer environment that is trusting, respectful, caring, cooperative and helpful. Developing identity is a key role for pre-adolescents and adolescents, and peer relationships in the school setting are an important influence in this process.	--	“STUDENTS at my school...	
			30.	...care about each other.”	
			31.	...don’t respect each other’s differences.”	
			32.	...try to protect each other.”	
			33.	...don’t trust each other.”	
			34.	...cooperate with one another when working on schoolwork together.”	
			35.	.. are often friends with students of different races, religions, and cultures.”	
		Supportive Relationships – Teachers and Staff	Adults play a critical role in creating conditions that support student self-esteem, sense of accomplishment, and feelings of efficacy – all of these are critical for accomplishment and contribution later in life. Adult relationships with children and young people should convey support, attentiveness, praise and recognition, caring, safety, and trust.	--	“My TEACHERS...
				13.	...give me individual attention when I need it.”
				15.	...care about me.” (at least one)
	Supportive Relationships – School Leadership	School leadership by principals and vice-principals is important to modeling and setting the climate of the school as an institution with which students must effectively interact. School leaders should be available to students, and relate to them with openness, respect and concern.	16.	...know me well.” (at least one)	
			17.	...have confidence in me.” (at least one)	
			18.	...are available to me when I need them.” (at least one)	
			26.	“Teachers other adults at my school try to help me when I am feeling sad, angry, or depressed.”	
	Parental Involvement	Student perceptions that parents are welcome in the school, play an important part in it, and that they are interested and involved in their learning and in school events contributes to a meaningful connectedness to the school.	14.	... intervene when students are having problems with each other”	
			--	At my school, the principal or assistant principal...	
			36.	...is easy to approach if I have a problem.”	
			37.	...treats students with respect.”	
	School Connectedness	Sense of Belonging Students feel a sense of meaningful involvement and belonging in the school environment and community. A sense that they are a recognized, valued member of the community.	38.	...listens to student ideas.”	
			--	“My PARENT(s) or GUARDIAN(s)...	
40.			... know what my grades are.”		
39.			...are involved in my school life.”		
41.			... regularly attend school events, such as sporting events (e.g., football games, soccer games) or student performances (e.g., plays, musical performances).”		
42.			... talk to my teachers (e.g., in person, over the phone, by email).”		
--			“I think that...		
19.			“My school is a good match for me.”		
28.	“I look forward to going to school most days.”				
25.	“It’s easy for me to make friends at this school.”				
29.	“I feel like I am a part of this school.”				

Dimensions	Components	Description of Construct	Item #	Specific Items
	School Participation	Students participate in school recreational and other extra-curricular and in-school opportunities. Participation is a concrete, behavioral indicator of school engagement and a sense of belonging.	43.	"I regularly attend school events."
			44.	I regularly participate in this number of extra-curricular activities through my school..." ...none; ...one activity; ... two activities; ...three activities; ...four activities, ... five or more activities
Safety	School as a Safe Place	Sense of Safety	27.	"I feel safe at my school."
		Acceptance of Differences	--	Students at my school are sometimes teased or picked on about...
			53.	...their weight or physical appearance."
			54.	...the amount of money their family has."
			55.	...their race/culture/religion."
			56.	...their disability."
			57.	...their group of friends."
			58.	...their dating or sexual history."
		Freedom from Bullying and Harassment	--	... In the last year, how many times did someone from your school...
			59.	... make fun of you because of something about you (e.g., race, ethnicity, religion, gender, disability, weight, physical appearance, or other difference
			60.	... try to hurt your feelings on purpose by spreading rumors about you, giving you the silent treatment, or excluding you from a group."
			61.	... make it hard to concentrate on your school work because of teasing or bullying."
			62.	... punch you, kick you, or beat you up
			63.	... try to hurt your feelings on purpose using text messages, phones, emails, Facebook, MySpace, or other electronic way
			64.	... make you feel bad during the school day because of teasing or bullying outside of school (e.g., in your neighborhood, at home on the computer).
			65.	... damage your property on purpose.
			66.	...make sexual comments, jokes, gestures, or looks towards you.
			67.	... touch, grab, or pinch you in a sexual way.
		Physical Safety	--	STUDENTS at my school...
			45.	...carry guns or knives to school."
	46.	...belong to gangs."		
	47.	...threaten to hurt other students."		
	48.	...steal money, electronics, or other valuable things while at school."		
	49.	...damage or destroy other students' property."		

Dimensions	Components	Description of Construct	Item #	Specific Items	
Freedom from Substance Use			50.	...damage or destroy school property.”	
			51.	...fight a lot.”	
			52.	...are sometimes physically hurt their boyfriend or girlfriend while at school.”	
	Freedom from Substance Use	Students population is are free from distraction or concern related to peers using substances while at school or school sponsored-events	--	“I think that...	
			90	...it is easy for students to use/try alcohol or drugs at school or school-sponsored events without getting caught.”	
			85	...students use/try tobacco products while at school or school-sponsored events.”	
			86	...students use/try alcohol or drugs while at school or school-sponsored events.”	
			87	...students buy or sell drugs, alcohol, or tobacco products while at school or school-sponsored events.”	
			88	...students are sometimes distracted in class because they are drunk or high.”	
			89	It makes me uncomfortable when other students bring drugs or alcohol to school or school-sponsored events.	
	Personal Substance Use	Students report no use of alcohol, tobacco, or other drugs in the last 30 days. Substance use is associated with negative school performance	--	“In the last 30 days, I have...	
			1.	...used or tried tobacco products (e.g., cigarettes, chewing tobacco)	
			2.	...drank alcohol (e.g., beer, wine, liquor, mixed drink)	
			3.	...I drank five or more servings of alcohol in a row (<i>one serving = one beer, one glass of wine, one shot of liquor</i>)	
4.			...used or tried marijuana (e.g., pot, weed, hash)		
5.			used or tried other drugs or substances to get high (e.g., illegal or synthetic drugs, prescription medication not prescribed to you by a doctor, inhalants)		
Environment	Clear and Fair Enforcement of Rules	Rules and disciplinary procedures are perceived to be clear, well communicated, and reasonable. School leaders, teachers, and other staff (e.g., SRO’s, transportation staff) should be perceived as fair in implementing rules and procedures. Fairness requires consistency and equity in applying rules, including consistency across individual teachers and school staff.	--	“I think that...	
			68	...students have respect for teachers and other adults at this school.”	
			70	...the school rules have been communicated to me clearly.”	
			69	...adults in this school follow the rules and procedures.”	
			71	...adults in this school apply the same rules to all students equally.”	
			72	...the students and teachers here try to decide together what the class rules will be.”	
			76	...students at this school get punished equally when they break the same school rule.”	
	--	“I think that...			

Dimensions	Components	Description of Construct	Item #	Specific Items	
	Reasonable and Restorative Sanctions	Sanctions involve students in positive services and involvement with the school rather than simply removal and isolation.	73	...if you get in trouble at this school, you have a chance to tell your side of the story.”	
			74	...if you break the rules, adults at this school will help you learn from your mistake.”	
			75	...when a student gets in trouble at this school, an adult explains to them why they are getting punished.”	
	Challenging Academic Environment	Classroom Management	Students perceive classrooms to be free of distractions that can detract from learning.	--	“I think that...
				78	...I get distracted from my schoolwork by other students acting out in class.
				77	...the noise in my school disrupts my learning.
		Academic Motivation and Challenge	School work is clearly presented and designed to be challenging with sufficient support to achieve. Student achievements are noted and positive feedback is provided.	--	“Most of my teachers...
				6.	...notice if I have trouble learning something.
				7.	...often connect what I am learning to life outside the classroom.
				8.	...challenge all students to do their personal best.”
				10.	... allow me to revise my work to learn from my mistakes.”
				9.	... praise me when I work hard in school.”
				11.	...assign work that allows me to be creative and think for myself.”
				12.	... help me get excited about what I am learning in my classes.”
		Academic Confidence	Students feel capable, are confident in their abilities to learn, and feel that they can accomplish.	--	“I think that...
				20.	...my school is a place where I can learn and do well in my classes.”
				21.	...what I’m learning in my classes will be important in my future.”
				22.	...my school has helped me improve my study skills.”
	23.			...I can understand difficult concepts with the help of others in this school.”	
	24.			...teachers will help me graduate from high school.”	
Buildings and Grounds	Approval and Ownership of the Physical Environment Students feel a sense of ownership in the school building manifest in care for the physical plant.	--	“I think that...		
		82.	...my school grounds look like they are taken care of well.”		
		79.	...students are proud of how the school looks on the outside.”		
		80.	...there is a place on the school campus where I can post projects that I have worked on, such as a poster presentation, painting, or drawing.”		
		81.	...my school provides opportunities for me to express myself.”		
Graduation Plans	Future Educational Aspirations Intentions to graduate and intentions for further education are important potential outcomes of an improved school climate.	--	“I think that...		
		85.	...I definitely plan to graduate from high school.		
		86.	...I plan to continue my education after I complete high school.		

Appendix C: Definitions and Examples of NSCC Climate Constructs

NSCC Construct	Definition	How TDOE measures
Safety	Safety includes not only physical safety, but also social or emotional safety as well as the rules and norms of a school (Thapa, Cohen, Guffey, D’Alessandro 2013).	TDOE encompasses safety in several constructs. “School as a Safe Place” includes both students’ physical safety and the degree to which students feel their peers are accepting of differences. Freedom from Bullying and Harassment is a separate construct because TDOE has a specific goal to identify and reduce instances of school bullying.
Relationships	Relationships include relationships with peers, teachers, and authority figures at the school. This component of school climate also examines students respect for diversity and the degree to which students accept differences among peers (Thapa, Cohen, Guffey, D’Alessandro 2013).	The TDOE survey measures relationships through the construct “Safe and Supportive Relationships” which is broken down into relationships with students, teachers, and administrators. Another measure of relationships is captured through the “Parental Involvement” and “School Connectedness” constructs, although these are more tangentially related.
Teaching and Learning	Teaching and learning relates to the social, emotional, ethical, and civic learning in which students engage. It also measures ways that schools support learning for all students. Finally, teaching and learning measures student and teacher perceptions of school climate as it relates to one’s ability to learn. (Thapa, Cohen, Guffey, D’Alessandro 2013).	The TDOE survey measures teaching and learning through the constructs “Future Educational Aspirations,” “Challenging Academic Environment,” and “Rules and Procedures” and the related sub-constructs.
Institutional Environment	The institutional environment component of school climate measures whether or not students feel that the building they are learning in supports or hinders learning. It measures whether or not students approve of the physical environment and if students have the resources they need to be successful at school (Thapa, Cohen, Guffey, D’Alessandro 2013).	The TDOE survey measures institutional environment by asking students about their “Approval of the Physical Environment.”
Other Constructs		In addition to measuring the constructs described by the National Center for School Climate, the TDOE survey asks students about their “Personal Substance Use” and “Freedom from Substance Abuse” because this aligns with the mission of the Office of Safe and Supportive Schools.

Appendix D: Survey Reliability and Validity

The survey posed 90 questions to high school students across the state. These ninety questions comprise eight constructs and nineteen sub-constructs which encompass many dimensions of school climate. Appendix A visually maps the survey constructs and sub-constructs. The 2011-12 iteration of the survey had more than 125 questions. In 2012-13, the survey writers cut the survey back to the ninety questions administered that year. After further analysis, two additional questions were eliminated from the survey altogether (per TDOEs discretion). To evaluate the survey instrument I analyzed both the reliability and validity of it.

Reliability of the Survey scales

Survey reliability assesses the degree to which a survey consistently measures the same dimension. It makes no claims on whether or not the questions measure the dimension originally designed to measure (i.e. valid).

To evaluate the reliability of the survey constructs, I computed Chronbach's alpha, a psychometric estimator used to analyze the inter-correlation among questions. Chronbach's alpha increases as the relationship between questions increases and thus indicates the degree to which the questions measure the same dimension. Generally, an alpha greater than or equal to 0.7 is considered acceptable (Tavakol and Dennick 2011). This analysis follows the convention described and uses 0.7 as the threshold for reliability.

All of the constructs and sub-constructs except one pass this threshold. Appendix B shows my results. "Supportive Student Relationships," a sub-construct of the "Supportive Relationships" construct has an alpha of 0.68. Unfortunately, there is not one question whose inclusion lowers the alpha more than others so there was not a solution to make it more reliable. As the analysis proceeds, I plan to be cognizant of the low inter-correlation of the questions in this construct.

Validity of the Measures

Survey validity refers to the degree to which a set of questions/items measures what it set out to measure. Assessing the validity of the survey involves both qualitative and quantitative analysis.

To assess the validity, I first examined the creation of the survey to determine if TDOE designed the survey in alignment with the research-based definitions of school climate. To create the survey, TDOE called on survey experts, students, teachers, and parents. Together, representatives of these groups discussed and defined each construct then wrote questions to measure each. While doing this, survey experts helped community members write strong questions and provided guidance from other school climate surveys and personal experience. Additionally, as Table A showed, the TDOE constructs and questions align with national norms. This contributes to my evaluation of the survey measures being valid. However, I turn to quantitative data to further test this theory.

To further assess validity I examined the correlations among the three topics and eight high level constructs. Owing to the fact that all question responses were re-ordered such that one indicates a negative description of the school and five indicates a positive description of the school, I expected the correlations to all be positive but to vary in magnitude. When conducting

this analysis I checked the correlations of the three major topics (relationships, safety, and environment) as well as the correlations among the eight major constructs. As Appendix C shows, the correlations were all positive. Further, the magnitude of the correlations are consistent with findings from previous studies. For example, correlations between “Freedom from Bullying and Harassment” and all constructs are fairly low, except “School as a Safe Place”. Another example is the relationship between “School Connectedness” and “Safe and Support Relationships” – a very high correlation, which one would expect.

The combination of qualitative and quantitative analysis lead me to conclude that the survey instrument is likely both reliable and valid. To further test this theory, TDOE might compare instances of bullying documented at the school level with student reports of safety and bullying. This will provide further evidence that students are accurately reporting their experiences on the survey.

Table A: Survey Reliability Using Chronbach's Alpha

Construct Name	# Questions	Chronbach's Alpha for Construct	Sample Question Item (Responses are "Strongly disagree" to "Strongly agree" unless otherwise noted)
ENGAGEMENT	24	0.88	
Supportive Relationships	15	0.83	"My teachers give me extra attention when I need it"
Supportive Student Relationships	6	0.68	"Students at my school care about each other."
Supportive Relationships with Teachers	6	0.83	"I have at least one teacher who cares about me."
Supportive Relationships with School Leaders	3	0.86	"At my school there is at least one principal or assistant principal who is easy to approach if I have a problem."
Parental Involvement	4	0.77	"My parents or guardians are involved in my school life."
School Connectedness	5	0.75	"I feel like I am a part of my school"
SAFETY	34	0.91	
School as a Safe Place	23	0.90	"Students at my school carry guns or knives to school."
Acceptance of Differences	6	0.88	"During this school year, how often has anyone called you an insulting or bad name at school having to do with your race or ethnic background"
Physical Safety	8	0.90	"Students at my school threaten to hurt other students."
Freedom From Bullying and Harassment	9	0.89	"During this school year, how many times has someone from your school spread rumors about you?" Response choices: "Almost every day" to "never."
Freedom From Substance Abuse	11	0.80	I think that students use/try tobacco products while at school or school-sponsored events.
Freedom From Peer Substance Use	6	0.87	I think that students buy or sell drugs, alcohol, or tobacco products while at school or school-sponsored events.
Personal Substance Use	5	0.85	"In the past thirty days I have used or tried tobacco products (e.g., cigarettes, chewing tobacco)... 0 times, 1 time, 2-5 times, 6-10 times, more than 10 times."
ENVIRONMENT	30	0.91	
Rules and Procedures	10	0.88	"I think that when a student gets in trouble at this school, an adult explains to them why they are getting punished."
Clear and Fair Enforcement of Rules	6	0.77	"I think that the school rules have been communicated to me clearly."
Reasonable and Restorative Sanctions	4	0.84	"I think that if you break the rules, adults in this school will help you learn from your mistake."
Challenging Academic Environment	16	0.83	"Most of my teachers allow me to revise my work and learn from my mistakes."
Classroom Management	2	0.85	"I think that the Noise in my classroom disrupts my learning."
Academic Motivation and Challenge	7	0.81	"Most of my teachers assign work that allows me to be creative and think for myself."
Academic Confidence	7	0.80	"I think that I can understand difficult concepts with the help of my teachers."
Approval of the Physical Environment	4	0.77	"I think that my school grounds look like they are well taken care of."
Future Educational Aspirations	2	0.86	"I think that I definitely plan to graduate from high school."

Appendix E: Representativeness of the Survey

In addition to generalizing to the entire survey sample, TDOE should be cautious generalizing to the district and state levels. Prior to administering the survey, TDOE selected schools to participate. Selection was based on need, representativeness of the state, and other factors that may limit ability to participate. The resulting sample contained 27 districts comprised of 114 schools that signed memorandums of agreement to participate and received an addition \$20 per pupil. In total, the selected schools had 101,855 students enrolled during the 2012-13 academic year. Of these, 69,480 students began the survey. Among the completed surveys, 3,074 were incomplete and 2,126 were invalid. Survey analysts defined “invalid” as any survey where respondents answered straight down with one answer, answered in a pattern, or where completion occurred implausibly fast. This left 64,280 surveys for analysis (a 63% response rate).

This lack of completion and participation is potentially problematic because we do not know if there was a reason for omitting groups of students. If students were not surveyed at random owing to time constraints this would not be worrisome. However, if classes of students were omitted based on certain characteristics, there could be bias.⁷ One way to begin assessing the presence of systematic bias is to assess the representativeness of the survey in reference to the statewide population as well as the schools represented. On the survey, the only identifying information available is race, gender, and grade level.

There were 19,441 survey takers with missing achievement data. Missing students were 49.6% female and 50.4% male. Seventy-five percent of missing students were white, 16% were African American, 4% Hispanic, 2% Asian, and less than 1% Native American. Among missing students 27% were in 9th grade, 25% in 10th grade, 24% in 11th grade and 24% in 12th grade. 45% of students with missing achievement scores attend rural schools and 36% attend urban schools.

Representativeness by Race

Table A displays the representativeness of the matched survey takers relative to the survey sample, the schools sampled, and the state population on the basis of race. While the matched surveys deviate somewhat from the school sample, they match the racial breakdown statewide closely.

⁷ For example, if special education students were omitted, the survey may be biased upward because special education students are traditional victims of bullying and harassment and may have more negative perceptions of school climate than their surveyed peers. However, if the advanced classes were not surveyed, the theory that higher performing students view school climate more positively would suggest that our estimates for school climate are biased downward as these students would rate their school’s climate more positively than their surveyed peers. Because we do not know what happened or why students were not given the survey, it’s difficult to assess the bias of our estimates.

TableA.: Racial Representativeness of the Matched Survey Sample

<i>Sub-Group</i>	<i>Percent of Surveys Matched to Tests</i>	<i>Percent of Survey Sample</i>	<i>Percent of School Population</i>	<i>Percent of State Population</i>
White	69.19%	71.06%	74.72%	67.8%
Black	21.05%	19.56%	19.6%	23.6%
Hispanic	6.19%	5.45%	4.80%	6.6%
Asian/ Pacific Islander	2.32%	2.25%	1.9%	1.8%
Native American	0.85%	0.86%	0.28%	0.2%

Representativeness by Gender

Analyzing the representativeness of the survey sample was also important because there are some characteristics which may vary based on gender. For example, males and females view peer relationships and safety differently. Thus, it is important that the survey represents both genders well. Once again, I compared the matched survey sample to the full sample of surveys, to the subset of schools it represents, and to the state as a whole. Important to note is the fact that males were more likely to have unmatched surveys due to misreported student identification. However, even among the full survey sample (column 2 of Table B), females were over-sampled. This could indicate selection bias.

TableB.: Gender Representativeness of the Matched Survey Sample to the Population

<i>Sub-Group</i>	<i>Percent of Surveys Match to Tests</i>	<i>Percent of Survey Sample</i>	<i>Percent of Survey Population</i>	<i>Percent of State Population</i>
Female	50.47%	50.20%	48.36%	48.5%
Male	49.53%	49.80%	50.18%	51.5%

Representativeness by Grade Level

It is important to check for representativeness by grade level because there are situations where students in different grades might report different experiences with school climate. For example, 9th grade students who are new to the high school may report a low Sense of Belonging compared to their older peers. Below is the breakdown of grade levels in the survey sample. The matched surveys slightly oversample 9th – 11th grade students and under sample 12th grade students. However, due to the large number of survey responses, the statistical power made relatively small differences statistically significant. This does not necessarily indicate a substantially meaningful difference in this analysis.

Table C.: Grade-Level Representativeness of the Matched Survey Sample to the Population

<i>Sub-Group</i>	<i>Percent of Surveys Match to Tests</i>	<i>Percent of Survey Sample</i>	<i>Percent of State Population</i>
9 th grade	28.71%	28.23%	27.50%
10 th grade	25.91%	25.61%	25.68%
11 th grade	25.13%	24.74%	23.84%
12 th grade	20.25%	21.43%	22.98%