Measuring School Climate: Invariance across Middle and High School Students

Tracy E. Waasdorp[1],

Sarah Lindstrom Johnson[4]

Kathan D. Shukla[2],

Catherine P. Bradshaw[1,3,]

[1]Johns Hopkins University, [2]Indian Institute of Management Ahmedabad, [3]University of Virginia, Arizona State University[4]

Waasdorp, T. E., Lindstrom Johnson, S., Shukla, K. D., & Bradshaw, C. P. (2020). Measuring School Climate: Invariance across Middle and High School Students. *Children & Schools*, *42*(1), 53–62. https://doi.org/10.1093/cs/cdz026

Published in *Children & Schools*

Acknowledgement

This work was funded in part by grants from the U.S. Department of Education (Grant R305H1500027), the William T. Grant Foundation, and the National Institute of Justice. We would like to thank the Maryland State Department of Education and Sheppard Pratt Health System for their support of this research through the Maryland Safe and Supportive Schools Project. The opinions expressed are those of the authors and do not represent views of the sponsors.

Abstract

Positive school climate has been consistently associated with many desirable student outcomes in both middle and high schools. However, there has been little work comparing the perceptions across these two school settings. The U.S. Department of Education conceptualized a three-factor model for school climate consisting of safety, engagement, and environment. Drawing on data from 29,720 middle and 34,950 high school students, the fit of the three-factor model was examined for measurement invariance, in order to explore if the measure functioned similarly across both middle and high schools. The results indicated measurement invariance, which suggests that practitioners and researchers can confidently compare findings across middle and high schools to inform local decision-making related to school-based programming. A series of multi-level analyses also explored the extent to which perceptions of school climate differed for middle and high school students; these results generally indicated that middle schoolers perceived the school more favorably than high schoolers. Implications of these findings for social workers are considered.

Key words: school climate, middle versus high school, measurement invariance

Measuring School Climate: Invariance across Middle and High School Students

School climate has been defined as the values, beliefs, and expectations in a school that ensure that students feel socially, emotionally, and physically safe (National School Climate Council, 2007). Positive school climate has been consistently associated with many desirable student outcomes including academic behaviors and those related to learning, such as disruptive behavior and suspension (Thapa, Cohen, Guffey, & Higgins-D'Alessandro, 2013). Unfortunately, school climate is rarely considered in school improvement planning efforts (Hopson & Lawson, 2011). Due to their expertise in ecological systems theory and interdisciplinary collaboration, social workers play a critical leadership role in school climate interventions and school improvement efforts (e.g., multi-tiered systems of support, socio-emotional learning, bullying prevention; Anderson-Ketchmark & Alvarez, 2010; NASW, 2012; Payton et al., 2000). However, low-burden yet valid measures of school climate are needed to inform the use of these types of preventive interventions, as well as understand their effects on school climate across multiple schools.

School climate is often measured through surveys of stakeholder perceptions of the school environment (e.g., Bradshaw, Waasdorp, Debnam, & Lindstrom Johnson, 2014). The U.S. Department of Education (USDOE) conceptualized a three-domain model for school climate consisting of safety, engagement, and environment. Prior research has validated this model in high schools using a classical testing theory (CTT) framework, like factor analysis (Bradshaw et al., 2014); however, additional work is needed to understand whether this measure of school climate also holds true in middle schools. More specifically, one might ask whether school climate means the same thing in middle schools as high schools, and thus whether it should be measured the same way across these two different developmental levels. From a

measurement perspective, it is often assumed that a particular measure is assessing the same construct across settings. As such, the measure should be "invariant" across subgroups (e.g., middle and high schoolers), thereby enabling school staff to compare scores across school types. To determine this in relation to school climate, we assessed measurement invariance (MI) across middle and high schoolers (Segeritz & Pant, 2013). Once MI was established, we then tested whether the climate was more favorable in middle schools compared to high schools. Having a better understanding of the appropriateness of the USDOE school climate model for both middle and high school students may inform social workers' decision-making related to school improvement efforts and the use of preventive interventions across different school types.

Measurement Invariance (MI)

As described above, MI needs to be established prior to evaluating if there are group differences in the school climate across middle and high schools (Byrne & Van de Vijver, 2010). Given school climate is a latent variable (i.e., it cannot be directly observed), a measurement model is used to examine the association between the individual items participants respond to on the survey in relation to the latent variable. Toward that end, MI assesses whether the latent variable of school climate is invariant across the groups (middle vs. high) by imposing various constraints on the measurement model of latent variables across groups in three stages (Sass, 2011). First, configural invariance tests the validity of the hypothesized factor structure across different groups of participants; this is done to test if the same items measure the construct (i.e., school climate) similarly for the two groups. Next, metric invariance is tested, by building on configural invariance to examine if not only the items (i.e., configural) but the factor loadings are equivalent across the groups. Specifically, metric invariance indicates that the association between the items and the latent climate factor is identical across groups (i.e., middle vs. high);

therefore, a one-unit increase in score on an item has a comparable unit increase on its factor score across both middle and high schoolers. The final step is to test scalar invariance, which allows one to compare scale-score means across middle and high schools.

Measuring School Climate in Secondary Schools

Although much research and theory (e.g., stage environment fit; Eccles et al., 1993) has focused on understanding differences in students' perceptions and behaviors from elementary to middle school (e.g., Haltigan & Vaillancourt, 2014), less is known about differences between middle and high school. These differences are important to understand both as this transition carries risk for dropping out of school (Benner, 2011), as well as the fact that involvement in many risk behaviors becomes normative during middle and late adolescence (DiClemente, Hansen, & Ponton, 2013). However, these developmental time periods also bring consolidated identity formation which may explain findings that behaviors, such as bullying, peak in middle school (Waasdorp, Pas, Zablotsky, & Bradshaw, 2017). As many of these constructs (e.g., engagement in learning, drug use, bullying) are included in measures of school climate as well as the focus of school-wide preventative interventions, it is critical to have measures that function similarly for both middle and high schools; such tools allow social workers and other practitioners to identify schools that are in need for additional programming and track student-level perceptions over time (Fried et al., 2016).

Present Study

The current study examined MI of the USDOE's safe and supportive school climate model among the middle and high school students, with particular focus on the three broad domains of safety, engagement, and environment, and the relevant subscales. Once the scalar invariance (full invariance) was established, we investigated if the groups differed on scale

scores after controlling for student-level and school-level demographics. Specifically, this study aimed to determine: 1) Is the MDS3 School Climate Survey model of school climate appropriate for both middle and high school students; and, 2) Do middle and high schools differ in perceptions of school climate after accounting for student and school demographics?

Method

Participants

The participants included 29,720 middle school and 34,950 high school students (total N = 64,670 students). Middle school students (50.5% Male) were from 49 schools. The racial breakdown for the middle school sample was: 42.0% White, 24.4% African American, 14.7% Hispanic, 6.4% Asian, 2.9% Native American, .6% Native Hawaiian or other Pacific Islander, and 8.9% other or multi-racial. The high school students (50.0% Male) were from 65 schools. Similarly, the racial breakdown was: 54.6% White, 26.8% African American, 5.3% Hispanic, 4.5% Asian, 1.9% Native American, .6% Native Hawaiian or other Pacific Islander, and 6.3% other or multiracial.

Procedure

The Maryland State Department of Education recruited schools to participate in the Maryland Safe and Supportive Schools (MDS3; see Bradshaw et al., 2014) statewide initiative. Participation was voluntary for both middle and high schools and for the individual youth in the MDS3 initiative. The available data indicated that participation rates exceeded 90% across the schools. School staff administered the anonymous self-reported online survey following a written protocol. These data were approved for analysis by the relevant Institutional Review Boards.

Measure

The Johns Hopkins Center for Youth Violence Prevention in collaboration with project partners, developed the MDS3 School Climate Survey. The core climate survey is comprised of

56 items that reflect the three domains of the USDOE model of school climate, specifically *Student engagement, School environment,* and *Safety* (American Institutes for Research, 2016; see Bradshaw et al., 2014; Shukla et al., 2017 for more details regarding the validation of the measure in High school and Mexican samples). See Table 1 for the subscales and items. All answer choices were on a 4-point Likert scale from *strongly agree* to *strongly disagree*. All items were averaged within scale, with high scores representing a more favorable school climate. The measure is freely available by contacting cbradsha@jhsph.edu.

School-level covariates. Several school-level demographic variables were obtained from the MSDE for inclusion in the models as school-level covariates to adjust for possible school-level associations. Specifically, enrollment (school size), suspension rate, percent of minority students, and percent of students receiving free and reduced priced meals (a proxy for socioeconomic status) were analyzed.

Analysis

MI tests were conducted for the domains of engagement, environment, and safety separately for middle and high school students using the M*plus* 7.1 software (Muthén & Muthén, 1998-2016). Configural, metric, and scalar invariance were all tested using a series of analysis models; at each step, an additional level of equality constraints are introduced. For configural invariance (Sass, 2011), goodness of fit was assessed using root mean square error of approximation (RMSEA; $\leq .10$; Fan, Thompson, & Wang, 1999), standardized root mean square residual (SRMR; $\leq .08$), and the comparative fit index (CFI $\geq .95$; Hu & Bentler, 1999). Next, more restrictive conditions were imposed for investigating metric invariance; holding the unstandardized factor loadings equal across groups, metric invariance is evaluated through acceptable changes in alternative fit indices (i.e., CFI, RMSEA, SRMR). For the change (Δ) in

CFI, researchers suggest a range of $\leq .005$ to $\leq .01$ (Cheung & Rensvold, 2002), with some suggesting a more conservative criterion of $\leq .002$ (Meade, Johnson, & Braddy, 2008). Given the lack of consensus, we considered additional alternative fit indices, as well as the magnitude of difference in parameter estimates between successive models across the groups (Sass, 2011). For scalar invariance, unstandardized factor loadings and intercepts were constrained to be equal across groups. A similar procedure was used to determine the existence of significant changes. Again, if all of these suggest invariance across groups, then comparing the scores between middle school and high school is justified. We used maximum likelihood estimation with robust standard errors (MLR estimator) and adjusted the standard errors to accommodate the nested data structure (students nested within their schools) (Muthén & Muthén, 1998-2016). Finally, multilevel multivariate models were run to examine the second research question. Three separate multilevel models were fit in M*plus* for the scale scores on engagement, environment, and safety. These models included gender and race at the student level, and school demographics (enrollment, percent eligible for free and reduced priced meals (FARMS), suspension rate, percent minority, and school-type (0= middle vs. 1 = high) at the school level.

Results

Measurement Invariance for Engagement

Findings revealed the six-factor model fit the data well (see Table 2 for associated fit statistics; see Table 1 for the 6 engagement scales). There was no significant change in fit when comparing the configural invariance and metric invariance models suggesting metric invariance across middle and high school students for engagement. Next, the scalar invariance model was compared with the metric invariance model. The change in model fit statistic was negligible (ΔCFI = .001, ΔRMSEA = .002, ΔSRMR < .001). These results provide strong evidence for

invariance (configural, metric, and scalar) across middle and high school students for the engagement factors (see Table 2 for associated fit statistics). Examination of the freely estimated intercept and factor loading values further suggest matching patterns across all the engagement scales between middle and high school students; together, these findings suggest for full MI.

Measurement Invariance for Environment

The environment scale had four factors (see Table 1 for the factors), the baseline model of these factors suggest that configural invariance was supported by the model fit statistics (see Table 2 for fit statistics). Successive constraints of equal loadings (i.e., metric invariance) and equal loading with equal intercepts (i.e., scalar invariance) suggested that the change in fit was within acceptable limits. The loading and intercept freely estimated intercepts also suggested an identical pattern for middle and high school students.

Measurement Invariance for Safety

The safety scale had three factors (see Table 1 for the factors), this model also indicated configural invariance with a good fit (see Table 1 for fit indices). Similar to the engagement and environment scales, metric as well as scalar invariance was found for safety scales with insignificant change in fit indices (Table 2, metric and scalar models for safety). Inspection of freely estimated intercepts (Table 1) suggested an identical pattern of loading and intercept values across middle and high school groups.

Convergent Validity Examination

In a model that included the 13 subdomains of school climate, the 6 factors for engagement, 4 for environment, and 3 for safety, a multi-group CFA was run. In order to examine the convergent validity of school climate scales, the analyses allowed the subdomains to covary freely across the middle and high school student groups. This model had an acceptable fit

(CFI= .942, RMSEA =.033, SRMR= .056), see Table 3 for correlation coefficient values for both groups across the latent school climate factors.

For middle schoolers, all subdomain correlations were significant and positive with values ranging from .23 to .84 (Table 3, lower off-diagonal values). Correlations ranged from .55 to .84 for engagement, .60 to .82 for environment, and .33 to .60 for safety. High schoolers had a similar pattern for all of the subdomains (Table 3, upper off-diagonal values). Correlations ranged from .51 to .80 for engagement, .37 to .76 for environment, and .29 to .67 for safety. High schoolers had a similar pattern for all of the subdomains (Table 3, upper off-diagonal values).

Group Differences on School Climate Scales

Once the full invariance was established for all three domains of school climate (engagement, environment, and safety), we examined if middle schoolers differed from high schoolers on school climate scales, after controlling for student and school demographics (see Table 4). Middle school students were significantly more likely to report higher levels of engagement; specifically, they reported higher/better student-teacher connection, student-student connection, academic achievement, school connectedness, equitable school culture, and parental involvement than high schoolers. Middle schoolers were significantly more likely to report higher levels on the environment scale; specifically, they reported more favorable/positive perceptions of school rules and consequences, more physical comfort, and a more supportive environment than high school students. Finally, middle school students were significantly more likely to report higher levels on the safety scale; specifically, they reported better physical safety and less drug use than high school students. However, middle schoolers tended to report higher levels of bullying than high schoolers, but this difference was not statistically significant (p = .06).

Discussion

This paper explored differences in the functioning of the MDS3 School Climate Survey across middle and high school students. The MI analyses provided strong evidence of invariance across middle and high schoolers. This finding is critical as it indicates that school climate can be measured the same way across these two levels, and that the mean level differences in perceptions of school climate are meaningful and not the result of measurement bias. This is important information; first, it supports the use of the same measure across middle and high schools, and school staff can be confident that the measure is assessing the same construct without bias. A prior study of this measure examined MI for race/ethnicity differences and gender differences; importantly, that study also found that this measure was unbiased for these subgroups (Bradshaw et al., 2014), further supporting the use of this measure across different developmental levels, gender, and race/ethnic subgroups.

A second goal of the paper was to compare the perceptions of school climate across the middle and high school youth, while controlling for student- and school-level characteristics. The results comparing middle and high school students suggested that middle school students have more positive perceptions of school climate across all three domains of school climate (i.e., engagement, environment, and safety). These differences may be explained by developmental differences, contextual differences, or the interaction between the two (Eccles et al., 1993). These findings are consistent with prior research on developmental differences, most of which has focused on the engagement domain and suggested a decline in engagement from 7th through 11th grade (Wang & Eccles, 2012). Interestingly, this effect was strongest for emotional engagement (measured by school belonging, commonly assessed in school climate measures), compared to more cognitive and behavioral engagement. More work is needed to understand

poorer perceptions of school rules and consequences and support in high schools, particularly since the balance of rules to consequences (e.g., authoritative school climate) has been linked with lower peer victimization among both middle and high schoolers (e.g., Cornell, Shukla, & Konold, 2015). Peer victimization likely influences perceptions of safety, which are also less favorable in high schools. Perceptions of substance use as more of a problem in high schools may reflect the normative nature of experimentation with substances during adolescence (DiClemente et al., 2013). Further research is needed to explore possible causes for these and other developmental differences in perceptions of school climate between middle and high school students.

Limitations

Although this study includes a diverse sample of students and schools (e.g., urban/rural, middle/high), the data came from only one state. Additionally, school climate is often best assessed by multiple informants (Mitchell, Bradshaw, & Leaf, 2010); however, we only examined perceptions of students. The inclusion of data from parents or school staff may help further disentangle developmental from contextual differences. It would also be important to use MI to ensure that there is no measurement bias across these different informants as well. Similarly, observational data, collected by outside observers, may provide further insight regarding the variation in perceptions of the schools' physical environment in relation to other factors, such as student-teacher interactions (Cash, Debnam, Waasdorp, Wahl, & Bradshaw, 2019; Lindstrom Johnson, Bottiani, Waasdorp, & Bradshaw, 2018). Moreover, we used the U.S. Department of Education's 3-factor framework of school climate, but there remains a debate about the conceptualization of school climate. For example, some scholars have prioritized the engagement domain over other aspects of the physical environment (Payne, 2018). The

associations examined in this study were correlational; further developmental and experimental research is needed to explore possible causes of these differences in perceptions of climate.

Implications for Social Workers

Encouraging a positive school climate for all students is a fundamental job responsibility for school social workers (Byrne, Katz, Lee, Linz, & McIlrath, 2014). Having low-cost and low-burden, yet valid measures of school climate is essential to achieving this goal. These findings suggested that differences on this school climate measure are in fact meaningful and not an artifact of measurement bias (Byrne & Van de Vijver, 2010). Moreover, these results suggest that this measure can confidently and efficiently be used to inform decisions and track progress across both middle and high schools, and that comparisons can also be made across these school types using data from this measure. Given the known associations between school climate and student academic and behavioral outcomes (Thapa et al., 2013), school climate data can be particularly informative for school social workers (Hopson & Lawson, 2011).

Conclusion

This paper presents findings regarding the validity of the MDS3 School Climate Survey, which further bolsters its use as a low-cost and low-burden assessment of school climate. This measure includes information across three domains, safety, engagement, and environment, with subdomains addressing important constructs that support both educational and developmental outcomes. As such, social workers and other practitioners, along with researchers, can feel confident in this comprehensive tool for comparing middle and high school students' perceptions of school climate. Our findings of more favorable perceptions of school climate among middle schoolers versus high schoolers also highlights a need for more longitudinal research to better

understand the reasons for these development differences, as well as effective programs for improving school climate in high schools to address these concerning patterns.

References

American Institutes for Research. (2016). School Climate. Retrieved from https://safesupportivelearning.ed.gov/safe-and-healthy-students/school-climate

Anderson-Ketchmark, C., & Alvarez, M. E. (2010). The school social work skill set and positive behavior support: A good match. *Children & Schools, 32*(1), 61-63.

Benner, A. D. (2011). The transition to high school: Current knowledge, future directions. *Educational Psychology Review, 23*(3), 299-328.

Bradshaw, C. P., Waasdorp, T. E., Debnam, K. J., & Lindstrom Johnson, S. (2014). Measuring school climate: A focus on safety, engagement, and the environment. *Journal of School Health, 84*(9), 593-604. doi:10.1111/josh.12186

Byrne, B. M., & Van de Vijver, F. J. (2010). Testing for measurement and structural equivalence in large-scale cross-cultural studies: Addressing the issue of nonequivalence. *International Journal of Testing, 10*(2), 107-132. doi:10.1080/15305051003637306

Byrne, S., Katz, S. J., Lee, T., Linz, D., & McIlrath, M. (2014). Peers, predators, and porn: Predicting parental underestimation of children's risky online experiences. *Journal of Computer-Mediated Communication, 19*(2), 215-231. doi:10.1111/jcc4.12040

Cash, A. H., Debnam, K. J., Waasdorp, T. E., Wahl, M., & Bradshaw, C. P. (2019). Adult and student interactions in nonclassroom settings. *Journal of Educational Psychology, 111*(1), 104.

Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling, 9*(2), 233-255. doi:10.1207/S15328007SEM0902_5

Cornell, D., Shukla, K., & Konold, T. (2015). Peer victimization and authoritative school climate: A multilevel approach. *Journal of Educational Psychology, 107*(4), 1186-1201. doi:10.1037/edu0000038

DiClemente, R. J., Hansen, W. B., & Ponton, L. E. (2013). *Handbook of adolescent health risk behavior*: Springer Science & Business Media.

Eccles, J. S., Midgley, C., Wigfield, A., Buchanan, C. M., Reuman, D., Flanagan, C., & Mac Iver, D. (1993). Development during adolescence: The impact of stage€nvironment fit on young adolescents' experiences in schools and in families. *American Psychologist, 48*(2), 90-101. doi:10.1037/0003-066x.48.2.90

Fan, X., Thompson, B., & Wang, L. (1999). Effects of sample size, estimation methods, and model specification on structural equation modeling fit indexes. *Structural Equation Modeling, 6*(1), 56-83. doi:10.1080/10705519909540119

Fried, E. I., van Borkulo, C. D., Epskamp, S., Schoevers, R. A., Tuerlinckx, F., & Borsboom, D. (2016). Measuring depression over time Or not? Lack of unidimensionality and longitudinal measurement invariance in four common rating scales of depression. *Psychological Assessment, 28*(11), 1354-1367. doi:10.1037/pas0000275

10.1037/pas0000275.supp (Supplemental)

Haltigan, J. D., & Vaillancourt, T. (2014). Joint trajectories of bullying and peer victimization across elementary and middle school and associations with symptoms of psychopathology. *Developmental Psychology, 50*(11), 2426-2436. doi:10.1037/a0038030

Hopson, L., & Lawson, H. (2011). Social workers' leadership for positive school climates via data-informed planning and decision making. *Children & Schools, 33*(2), 106-118.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus. *Structural Equation Modeling*, *6*(1), 1-55. doi:10.1080/10705519909540118

Lindstrom Johnson, S., Bottiani, J., Waasdorp, T. E., & Bradshaw, C. P. (2018). Surveillance or safekeeping? How school security officer and camera presence influence students' perceptions of safety, equity, and support. *Journal of Adolescent Health*. doi:10.1016/j.jadohealth.2018.06.008

Meade, A. W., Johnson, E. C., & Braddy, P. W. (2008). Power and sensitivity of alternative fit indices in tests of measurement invariance. *Journal of Applied Psychology*, *93*(3), 568-592. doi:10.1037/0021-9010.93.3.568

Mitchell, M. M., Bradshaw, C. P., & Leaf, P. J. (2010). Student and teacher perceptions of school climate: A multilevel exploration of patterns of discrepancy. *Journal of School Health*, *80*(6), 271-279. doi:10.1111/j.1746-1561.2010.00501.x

Muthén, L. K., & Muthén, B. O. (1998-2016). *Mplus user's guide. Seventh edition.* Los Angeles, CA: Muthén & Muthén.

National Association for Social Workers. (2012). NASW standards for school social work services. . Washington, DC.: NASW.

National School Climate Council. (2007). National school climate standards: Benchmarks to promote effective teaching, learning, and comprehensive school improvement. . Retrieved from https://www.schoolclimate.org/themes/schoolclimate/assets/pdf/policy/school-climate-standards.pdf

Payne, A. (2018). *Creating and sustaining a positive and communal school climate: Contemporary research, present obstacles, and future directions* (NCJ 250209). Washington, D.C.

Payton, J. W., Wardlaw, D. M., Graczyk, P. A., Bloodworth, M. R., Tompsett, C. J., & Weissberg, R. P. (2000). Social and emotional learning: A framework for promoting mental health and reducing risk behavior in children and youth. *Journal of School Health, 70*(5), 179-185.

Sass, D. A. (2011). Testing measurement invariance and comparing latent factor means within a confirmatory factor analysis framework. *Journal of Psychoeducational Assessment, 29*(4), 347-363. doi:10.1177/0734282911406661

Segeritz, M., & Pant, H. A. (2013). Do they feel the same way about math? Testing measurement invariance of the PISA "students' approaches to learning" instrument across immigrant groups within Germany. *Educational and Psychological Measurement, 73*(4), 601-630. doi:10.1177/0013164413481802

Shukla, K. D., Waasdorp, T. E., Lindstrom Johnson, S., Orozco Solis, M. G., Nguyen, A. J., Rodríguez, C. C., & Bradshaw, C. P. (2017). Does School Climate Mean the Same Thing in the United States as in Mexico? A Focus on Measurement Invariance. *Journal of Psychoeducational Assessment*. doi:10.1177/0734282917731459

Thapa, A., Cohen, J., Guffey, S., & Higgins-D'Alessandro, A. (2013). A review of school climate research. *Review of Educational Research, 83*(3), 357-385. doi:10.3102/0034654313483907

Waasdorp, T. E., Pas, E. T., Zablotsky, B., & Bradshaw, C. P. (2017). Ten-Year Trends in Bullying and Related Attitudes Among 4th- to 12th Graders. *Pediatrics, 139*(6), 1-8. doi:10.1542/peds.2016-2615

Wang, M. T., & Eccles, J. S. (2012). Social support matters: Longitudinal effects of social support on three dimensions of school engagement from middle to high school. *Child Development, 83*(3), 877-895. doi:10.1111/j.1467-8624.2012.01745.x

Table 1.
Completely Standardized Parameter Estimates for Multigroup Confirmatory Factor Analysis

	Intercepts		Factor Loading	
ENGAGEMENT	Middle	High	Middle	High
Teacher Connectedness (α = .89 for middle & .88 for high)				
My teachers listen to me when I have something to say	3.58	3.46	0.8	0.80
My teachers care about me	3.75	3.44	0.84	0.83
Teachers respect the students	3.59	3.36	0.82	0.81
My teachers tell me when I do a good job	3.78	3.42	0.69	0.65
At this school, my teachers notice when I am not there	3.62	3.37	0.67	0.66
At this school, students trust the teachers	3.03	2.91	0.76	0.72
Student Connectedness (α = .87 for middle & .89 for high)				
I feel like I belong	3.40	3.05	0.67	0.67
Students help one another	3.28	3.08	0.82	0.83
Students respect one another	2.86	2.71	0.8	0.81
At this school, students like one another	3.34	3.07	0.76	0.81
At this school, students trust one another	3.09	2.67	0.78	0.8
Student Achievement (α = .78 for middle & .79 for high)				
My teachers believe that I can do well in school	4.42	3.95	0.82	0.81
I believe I can do well in school	4.73	4.28	0.61	0.6
My teachers always want me to do my best	4.65	3.94	0.82	0.82
It is important to finish high school	7.18	5.77	0.48	0.51
Whole-School Connectedness (α = .86 for middle & .84 for high)				
Students and staff feel pride in this school	3.42	3.10	0.72	0.66
I enjoy learning at this school	3.10	2.83	0.83	0.81
I like this school	2.98	2.69	0.83	0.81
I like coming to school	2.74	2.46	0.76	0.75
Culture of Equity (α = .83 for middle & .83 for high)				
At this school, students of all races are treated the same	3.11	2.83	0.80	0.80
At this school, all students are treated the same, regardless of whether their parents are rich or poor	3.10	2.87	0.82	0.82
At this school, boys and girls are treated equally well	3.21	3.09	0.76	0.77
The school provides instructional materials that reflect my culture, ethnicity, and identity	3.05	2.91	0.59	0.60
Parent Involvement (α = .74 for middle & .75 for high)				
The school tries to involve parents or guardians	4.18	3.74	0.71	0.70
When I do something good at school, my parent(s) or guardian(s) usually hears about it	3.48	3.17	0.51	0.51
Parents or guardians often come to my school to help out	4.56	3.97	0.64	0.62
My parent(s) or guardian(s) feels welcome at this school	2.59	2.39	0.67	0.69
If I do something bad at school, my parent(s) or guardian(s) hears about it	2.43	2.38	0.53	0.55

ENVIRONMENT				
	Intercepts		Factor Loading	
Rules & Consequences (α = .77 for middle & .75 for high)				
Students listen to the teachers	3.05	3.00	0.64	0.64
At this school, teachers can handle students who disrupt class	3.02	3.02	0.68	0.68
There are clear rules about student behavior	3.81	3.62	0.64	0.61
Students are rewarded for positive behavior	2.79	2.63	0.61	0.57
Everyone knows what the school rules are	3.40	3.3	0.61	0.57
Physical Comfort/Cleanliness (α = .80 for middle & .80 for high)				
The bathrooms in this school are clean	2.30	2.16	0.72	0.73
The school is usually clean and well-maintained	2.98	2.71	0.80	0.83
The temperature in this school is comfortable all year	2.59	2.32	0.60	0.57
This school has a bright and pleasant appearance	3.00	2.72	0.74	0.7
Support (α = .77 for middle & .78 for high)				
Teachers at my school help students with their problems	3.46	3.3	0.84	0.82
Students who need help for their problems are able to get it through school	3.49	3.31	0.80	0.79
There is someone at school who I can talk to about personal problems	3.06	2.87	0.58	0.61
Disorder (α = .50 for middle & .51 for high)				
Misbehaving students get away with it	2.83	2.81	0.48	0.41
There are often broken windows, doors, or desks in this school	3.49	3.12	0.55	0.62
Vandalism of school property is a problem at this school	2.91	3.12	0.48	0.53
SAFETY				
Bullying and Aggression (α = .66 for middle & .65 for high)				
Physical fighting between students	2.55	2.80	0.67	0.66
Harassment or bullying of students	2.33	2.41	0.72	0.72
Students intervene with bullying	2.69	2.65	0.53	0.5
Physical Safety (α = .60 for middle & .64 for high)				
I feel safe at this school	4.36	4.11	0.79	0.86
I feel safe going to and from school	4.61	4.36	0.69	0.77
Programs for violence	2.92	2.97	0.45	0.37
General Drug Use (α = .91 for middle & .87 for high)				
Students' drug use (such as marijuana, LSD, cocaine, ecstasy)	3.19	2.04	0.87	0.86
Students' tobacco use (cigarettes, chew, cigars)	3.57	2.14	0.90	0.81
The students at my school use alcohol (such as beer, wine, liquor)	3.84	2.18	0.88	0.81

Table 2
Model Fit Statistics.

	Model	CFI	ΔCFI	RMSEA	ΔRMSEA	SRMR	ΔSRMR
Engagement							
	Configural	0.974		0.047		0.048	
	Metric	0.974	<.001	0.046	0.001	0.05	0.002
	Scalar	0.975	0.001	0.044	0.002	0.05	<.001
Environment							
	Configural	0.995		0.038		0.033	
	Metric	0.995	<.001	0.037	0.001	0.036	0.003
	Scalar	0.995	<.001	0.033	0.004	0.037	0.001
Safety							
	Configural	0.989		0.039		0.041	
	Metric	0.989	<.001	0.036	0.003	0.043	0.002
	Scalar	0.992	0.003	0.028	0.008	0.046	0.003

Table 3.
Correlations between Latent Factors of School Climate

		1	2	3	4	5	6	7	8	9	10	11	12	13
1	Stu-tea	-	.73***	.80***	.76***	.61***	.78***	.75***	.47***	.76***	.37***	.37***	.53***	.21***
2	Stu-stu	.73***	-	.52***	.72***	.60***	.66***	.68***	.48***	.61***	.40***	.56***	.57***	.27***
3	Aca Eng	.84***	.56***	-	.68***	.51***	.65***	.59***	.34***	.63***	.29***	.27***	.48***	.15***
4	Sch Cnct	.81***	.72***	.74***	-	.57***	.69***	.66***	.54***	.65***	.42***	.44***	.56***	.22***
5	Cult Eq	.66***	.62***	.55***	.61***	-	.60***	.69***	.49***	.69***	.45***	.48***	.52***	.29***
6	Prnt Inv	.81***	.68***	.72***	.76***	.65***	-	.75***	.50***	.72***	.37***	.39***	.51***	.25***
7	Rules	.80***	.70***	.66***	.74***	.73***	.81***	-	.59***	.76***	.48***	.47***	.53***	.28***
8	Comfrt	.60***	.56***	.47***	.65***	.59***	.61***	.71***	-	.50***	.54***	.39***	.42***	.25***
9	Support	.80***	.64***	.68***	.71***	.72***	.78***	.82***	.62***	-	.37***	.36***	.49***	.20***
10	Disorder	.52***	.48***	.42***	.54***	.55***	.49***	.60***	.61***	.51***	-	.57***	.46***	.44***
11	Bullying	.44***	.57***	.33***	.49***	.53***	.44***	.52***	.49***	.43***	.64***	-	.60***	.67***
12	Phy Safe	.60***	.62***	.55***	.66***	.59***	.62***	61***	.54***	.58***	.53***	.60***	-	.29***
13	Drug use	.27***	.23***	.27***	.27***	.28***	.25***	.28***	.25***	.24***	.40***	.55***	.33***	-

Note. Lower off-diagonal represent correlations for middle and upper off-diagonal values represent high school students. Variables were recoded so that higher values reflect more positive perceptions of school climate. *$p < .05$; ** $p < .01$; ***$p < .001$

Table 4. Associations with Individual and School-level Factors.

	Engagement Scale						**Environment Scale**				**Safety Scale**		
	Teacher connect	Student connect	Achievement	School Connect	Culture Equity	Parent Involve	Rules	Comfort	Support	Delinq	Physical Safety	Bullying	Drug Use
ICCs	.07	.11	.04	.09	.06	.08	.08	.17	.05	.07	.09	.09	.27
Student-level													
Male	0.04***	0.12***	-0.02***	0.05***	0.03***	0.02***	0.01**	0.06***	0.01*	0.02***	0.03***	0.09	0.05***
Black	-2.59***	-2.48***	1.11**	-1.88***	-0.70	1.17**	-0.15	-0.68	-0.74*	3.51***	0.98	2.67***	3.89***
Hispanic	0.91***	1.12***	-0.23	1.62***	0.82***	0.50**	0.87***	1.80***	0.76***	0.99**	0.31	1.23***	-0.50
Asian	2.45***	1.91***	1.31***	2.19***	0.53*	0.49*	1.30***	1.10***	1.35***	-1.09***	0.62**	-0.63**	-0.67**
Native American	0.72***	0.76***	0.03	0.19	0.72**	0.06	0.09	0.15	0.31	-0.61**	0.03	-0.76***	-0.47
Native Hawaiian	1.01***	0.87***	0.07	0.65***	1.02***	-0.07	-0.12	0.01	0.37*	-1.08***	-0.03	-1.25***	-0.95***
Other	-2.51***	-2.18***	-2.29***	-2.78***	-2.39***	-2.15***	-2.00***	-2.38***	-2.05***	-1.72***	-1.94***	-1.25**	-1.31**
R2	0.004	0.017	0.001	0.005	0.002	0.001	0.001	0.005	0.001	0.004	0.001	0.01	0.005
School-level													
% Suspension	-0.06	-0.14	0.05	-0.13	-0.18	-0.07	-0.08	-0.08	-0.03	-0.18*	-0.01	-0.26**	0.10
% FARMS	-0.17*	-0.43***	-0.16	-0.31**	-0.33***	-0.25**	-0.4***	-0.33*	-0.29**	-0.49***	-0.64***	-0.56***	-0.24**
% Minority	-0.27	-0.17*	-0.08	-0.17	-0.11	-0.19*	-0.19*	-0.02	-0.16*	-0.07	-0.18*	-0.10	0.15
School Size	-0.09	-0.12	-0.07	-0.05	-0.13	-0.16*	-0.23*	-0.23	-0.16*	-0.40**	-0.24*	-0.21*	-0.22***
High	-0.72***	-0.52***	-0.78***	-0.54***	-0.53***	-0.71***	-0.5***	-0.28*	-0.67***	-0.09	-0.27**	0.23¥	-0.78***
R2	0.626	0.641	0.606	0.514	0.586	0.686	0.576	0.283	0.617	0.446	0.590	0.536	0.832

¥ $p = .06$ *$p < .05$; ** $p < .01$; ***$p < .001$. FARMS = free or reduced meals rate.