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School Climate as an Intervention to Reduce Academic Failure and Educate the Whole Child: A Longitudinal Study

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Abstract

BACKGROUND—Preventing student academic failure is crucial to student health and life success. Previous studies suggest a positive school climate may reduce students' risk for academic failure and contribute to academic success. The purpose of this study was to determine the longitudinal associations between school climate and academic grades in a group of middle school students who transition into high school.

METHODS—Parallel latent growth curve modeling was used to examine changes among study variables longitudinally using a sample of 2604 in 6th, 7th, and 8th-grade students across 16 regional schools located in 3 counties in West Virginia.

RESULTS—Students with higher perceptions of a positive school climate exhibited sustained or improved academic achievement over time ($\beta = 0.22$ to 0.30, $p < .01$). Higher positive perceptions of school climate appear to sustain students who earn As/Bs ($\beta = 0.20$ to 0.27, $p < .01$) and strengthen students who earn Cs/Ds/Fs ($\beta = -0.16$ to -0.46, $p < .05$).

CONCLUSIONS—Positive student perceptions of school climate may sustain high academic performance while strengthening students who earn Cs/Ds/Fs. School climate may be useful as an

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intervention to support school-based health promotion to reduce the achievement gap in the United States.

Keywords

middle school; early adolescents; achievement; parallel latent growth analysis

Academic success and earning a high school diploma is strongly associated with health throughout the lifespan. Research suggests that a higher prevalence of chronic disease and early death disproportionately occurs among the least educated.[2–4] In addition, people who leave school early are more likely to have occupational issues, social dysfunction, and engage in criminal behavior.[5–8] Economic and social demands for an educated labor force underscore the value of at least completing a high school education, which is often the minimum requirement for gainful employment and college admission.[9,10] Beyond the potential economic cost, educational attainment is also often required to open avenues for social mobility.[11,12] Preventing student academic failure is therefore crucial to student health and to support success in adulthood.[7,8,13]

Preventing risky youth behaviors that may lead to less than desirable student outcomes continues to be a challenge.[14,15] The US public (non-charter) school system serves an estimated 85% (47.3 million) of the child and adolescent population.[16–18] The public school system is, therefore, a promising location to implement large-scale primary prevention initiatives because of its broad capacity to provide health promotion and education to children and youth.[19,20] In addition, social-ecological theories suggest learning and modeling stems from interactions within an environment while sharing experiences with others while in school.[21–24] As a result, schools are places where most children and adolescents develop behavioral patterns that may follow into adulthood.[25–28] Therefore, a natural partnership exists between educators and health promotion researchers making public schools potentially ideal locations to implement population health interventions and research.[19,20] By working together, collaborative partnerships between public health and public education may have practical implications toward a shared and collective impact that may help accomplish national academic and health goals.

An Overview of School Climate and Academic Achievement

A positive school climate provides an excellent example of how a positive social environment may shape student behaviors.[20,29] However, definitions of school climate tend to diverge.[30] Tangible definitions are based on behavioral patterns of school life that are observed through norms, values, practices, and relationships.[31] Theoretical definitions describe school climate as the "spirit" or "heart beat" of a school.[32] Definition aside, most research has shown *social relationships* such as bonding with teachers and peers; *order and safety* such as respect for school rules; *academic opportunities* such as a sense of accomplishment and satisfaction with school; and *school connectedness* such as attachment and building social bonds to school tend to be essential constructs found in conceptual models of school climate.[30,33,34]

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Current school climate research, with an emphasis on ecological approaches, suggests school climate can shape the interactions between students, teachers, families, and the broader community.[35,36] From a school climate point-of-view, shaping may occur through high-quality classroom management and an emphasis on valued social norms where learning materializes, such as a classroom.[31,33,37] A collective goal of most school climate research has been to empirically highlight the importance of non-academic factors in lieu of an overemphasis on curriculum and instruction to support student success.[38] Studies focused on safe and positive school environments suggests strategies that foster a positive school climate may safeguard students from social inequalities like poverty toward improved academic performance.[39–41] Although, we know many factors associated with school climate occur while students are in school, the temporal nature of understanding how school climate shapes students' academic success is far from complete.[30] Longitudinal studies are needed to establish the dynamic process of school climate and its association to academic outcomes.[42] If school climate and academic achievement change together, such evidence may further support the improvement of school-based interventions.

An Opportunity for School Climate to Promote Academic Success

Clarifying relationships between school climate and student outcomes is especially relevant now as two large-scale policy initiatives advocate for the evaluation of school climate to support alignment with academics to reduce educational and health disparities. First, the Centers for Disease Control and Prevention (CDC) has developed the Whole School, Whole Child, Whole Community (WSCC) model to intersect health and education.[43] WSCC encourages schools to engage students using a platform that best meets their health and developmental needs to achieve successful academic and health outcomes.[44] Second, the US legislature put forth the Every Student Succeeds Act (ESSA).[45] This legislation is meant to empower schools and encourages the integration of WSCC.[46] The changes brought on by ESSA emphasize the use of school climate as an added measure of school safety and quality to compliment standardized metrics of school performance.[47] This recommendation is important because school climate information may provide useful guidance for school management and pedagogical strategies (ie, bonding relationships[48]) that may impact educational and health outcomes.[39] Hence, studies that illustrate longitudinal associations of school climate and academic achievement may have systemic implications that support decisions on how to reduce academic risk and potentially prevent negative student outcomes.

The purpose of this study was to determine the longitudinal associations between school climate and academic grades across 3 annual data collections (3 waves) from a group of middle school students who transition into high school. Due to the exploratory nature of this study, 3 research questions guided our methodology: (1) perceptions of school climate and self-reported academic grades would independently change over time, (2) measures of school climate would demonstrate positive associations to self-reported academic grades over time, and (3) students' academic achievement would demonstrate positive associations with measures of school climate.

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METHODS

Participants, Procedures, and Handling of Missing Data

Annual data collections (3 waves) occurred between 2015, 2016, and 2017 from moderately uniform student groups in 6th (37.8%), 7th (32.5%), and 8th (29.7%) grades across 16 regional schools from 3 counties located in West Virginia (WV) at baseline. For clarity, students in 6th grade in 2015 would be in 8th grade in 2017 and students in 7th grade would be in 9th grade and be in their first year of high school in WV. School size ranged from 130 (smallest) to 648 (largest) students from rural and suburban districts. Students from each county represent a spectrum of diverse characteristics from families living in severe isolation/poverty to modest privilege/affluence with 50% to 64% of children considered eligible for free or reduced price lunch.[49–52]

A letter was sent to parents to provide an opportunity to exclude their children (parental optout rate<1%).[53,54] Surveys were administered by classroom teachers with oversight from a school contact agent to ensure response confidentiality and data collection protocols. Participation was voluntary and made available to all students. Students were free to answer all or part of the survey and elect to stop participation at any time. For additional examples on the data source and collection procedures, see Kristjansson et al.[55–57]

In 2015 (time 1), students at baseline provided 6364 eligible observations (response rate = 82.6%). In 2016 (time 2), students provided 6336 observations (response rate = 82.0%). In 2017 (time 3), students provided 6278 observations (response rate = 81.3%). Student data were then matched over time using a unique self-reported identification number yielding a final sample of 2604 retained cases (3 data points per participant). With participant dropout rates common for longitudinal studies this level of attrition was anticipated.[58,59] To ensure data quality and estimate accuracy, omnibus tests under the Unrestricted Latent Class Indicator models for data missing completely at random (MCAR) were shown to be non-significant (all $p > .05$).[60,61] Preliminary tests additionally demonstrated less than 5% missing on dependent variables under pairwise techniques on retained cases, which has been shown to produce stable estimates.[62] Conservatively, we assumed missing data patterns as a function of missing at random (MAR).[60] Missing data were then handled using full information maximum likelihood estimation (FIML).[63,64] This strategy was chosen because FIML yields unbiased estimates under MAR hypotheses and is often equivalent to computationally heavy imputation techniques.[65–69]

Measures

Academic grades—Self-reported grades were captured using a single question, “What were your FINAL grades in the following subjects LAST year?” for Mathematics and English. Responses were combined to represent students’ overall grades at each time point.[70–72] Academic grades were then pooled into ordered categories, Mostly As/Bs (coded 2), Mostly Cs (coded 1), and Mostly Ds/Fs (coded 0). Mostly As/Bs signified higher academic performance.

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School climate—Three sub-scales (positive student-teacher relationships, order and safety, and opportunities for student engagement) were selected from the School Climate Measure (SCM) developed by Zullig et al.[34,73,74] The 3 sub-scales were chosen because they have demonstrated the most robust psychometric support within the SCM and are common measures among other school climate instruments.[73] SCM questions use a 5-point Likert type scale with response options "strongly disagree" (coded 1) to "strongly agree" (coded 5). Higher scores indicate a more positive perception of school climate.

Covariates

Study covariates were selected and supported using citations based on a review of school and student-based outcomes literature.

Biological sex—Biological sex[57,75,76] was assessed by asking respondents "Are you a boy or girl?" Male (coded 0) and female (coded 1) were represented as a dichotomous time-invariant covariate.

Family structure—Respondents were asked to indicate their family structure[57,75] using a 19-item multi-response question, "Which of the following persons live in your home?" For analysis, the question was dichotomized into "lives with both biological parents" (coded 1) and "other arrangements" (coded 0) and represented as a dichotomous time-invariant covariate.

Maternal education—Maternal education[75,77] was captured by asking students to select 1 of 9 response options from a singular question "What is the highest level of schooling your mother has completed?" Responses were pooled into categories to simplify analyses, "college graduate" (coded 3), "high school graduate" (coded 2), "less than high school" (coded 1), and "I don't know" (coded 0) and represented as a nominal categorical time-invariant covariate.

Data Analysis

Descriptive statistics were analyzed using SAS 9.4® (Cary, NC)[78] and include frequencies, means, standard deviations, scale reliability, and confirmatory factor analysis estimates. Parallel latent growth curve modeling (PLGM, Figure 1) was selected to examine linear changes in school climate sub-scales and academic grades while controlling for sex, family structure, and maternal education.[79] All PLGM analyses were performed in Mplus 8.0© (Los Angeles, CA)[80] using a 2-tailed distribution with p-values equal to or less than .05. The complex option was used in Mplus to accommodate for statistical anomalies such as non-normality and non-independence of data with robust standard errors and probit transformation.[80–82] These options were used to account for children clustered in schools, which when overlooked, may produce inaccurate results. Numerical integration with unconstrained residuals[80] was also used to appropriately handle the interaction between latent categorical (non-normal) and continuous (normal) intercepts (start-point) and slope (growth trajectory). The deviance statistic (−2LL),[83,84] Akaike Information Criteria (AIC), and Bayesian Information Criteria (BIC) were used to judge which model best fit our sample data. Latent regression path estimates (B) and standard errors (SE) indicate the relationship

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between school climate and academic grades over time. Standardized regression estimates, represented by beta (β), were used to demonstrate the practical importance of the relationship between school climate and academic achievement. Lastly, to support this study's findings, we used a sensitivity analysis and tested the same models on a middle school only sample of students who started in 6th grade and ended in 8th grade (students who did not transition into high school, N = 966) and a sample of high school only students (N = 531) who started in 9th and 10th grade and ended in 11th and 12th grade.

RESULTS

Eighty percent of students reported earning As/Bs at time 1 and 74.9% at time 3. On average, students perceptions of school climate was slightly positive and ranged 3.3 (SD = 0.9) at time 1 and 3.7 (SD = 0.8) at time 3. All school climate sub-scales indicated acceptable reliability (α = 0.85 to 0.94) and factor analysis measurement fits between time 1 and time 3: χ^2 = 929.17–950.61 (all df = 157, p ≤ .01), comparative fit index = 0.97–0.98, Tucker-Lewis index = 0.96–0.97, standardized root mean square residual = 0.02–0.03, root mean square error of approximation = all 0.044 (±CI 90% 0.041, 0.047). Table 1 reports additional descriptive statistics.

Figure 1 depicts a conceptual model of the PLGMs with results reported in Tables 2–4. For reporting parsimony and clarity please refer to Tables 2–4 for additional model statistics such as between-person intercept (start-point) and slope (growth) means.

Table 2 reports the associations between student-teacher relationships (SC1) and academic grades. Changes in growth for student-teacher relationships across all academic grade groups were significant and ranged β = −0.26 to −0.24 (SE = .09 to .10, all p < .01). Changes in growth between student-teacher relationships on academic grades (cross-lagged paths) were significant and ranged −0.45 to 0.30 (SE = .08 to .11, all p < .05). Growth trajectories between academic grades on student-teacher relationships demonstrated no significant associations. Correlations between slopes ranged −0.29 to 0.30 (SE = .10 to .15, all p < .05).

Table 3 describes the associations between order and safety (SC 2) and academic grades. Growth trajectories for order and safety across all grade models were significant and reported relatively consistent changes β = −0.25 (all SE = .09, p < .01). Changes in growth for academic grades found significant associations for all-academic grades (ie, A-F) grouped together (−0.31, SE = .16, p < .05) and mostly Ds/Fs (−0.55, SE = .26, p < .05). The growth relationship between order and safety on academic grades were significant and ranged −0.46 to 0.29 (SE = .01 to .11, all p < .05). Growth trajectories between academic grades on order and safety indicated significant associations with the mostly As/Bs (−0.11, SE = .05, p < .05) and mostly Cs (−0.15, SE = .07, p < .05) groups. Significant correlations between slopes were found for the all-academic grades (ie, A-F) grouped together and the As/Bs group (0.25, SE = .11, p < .05).

Table 4 summarizes the associations between student engagement (SC 3) and academic grades. Student engagement growth trajectories were all found to be significant and ranged

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−0.25 to −0.29, SE=.04 to .06. Similar to order and safety, only significant associations were found for the all-academic grades grouped together (−0.32, SE=.16, $p < .05$) and mostly Ds/Fs (−0.54, SE=.27, $p < .05$). All growth associations between student engagement on academic grades ranged −0.46 to 0.29 (SE=.09 to .11). Mostly Cs (−0.15, SE=.07, $p < .05$) demonstrated the only significant growth associations between student engagement on academic grades. Lastly, the all-academic grades (ie, A-F) grouped together (0.26, SE=.10, $p < .01$) and As/Bs group (0.24, SE=.10, $p < .05$) demonstrated significant correlations between slopes.

DISCUSSION

Previous empirical evidence suggests schools that foster a positive school climate are more likely to deliver academically prepared and well-rounded students.[32,85] As a result, schools become places where students want to spend their time because it enriches their life, which ultimately supports success in school and preparation for adulthood.[86–88] In this study, we sought to determine the associated growth trajectories between school climate and academic grades in a sample of students who started in middle and transitioned into high school. The study presents 5 main findings: (1) academic grades changed over time, (2) school climate changed over time, (3) students with more positive perceptions of school climate sustained As/Bs and improved Cs/Ds/Fs over time, (4) teacher relationships demonstrated the most robust effects on academic grades, and (5) sensitivity analysis revealed a few notable differences among independent samples of middle and high school students. Although the findings are by no means definitively causal, the study design and analytical techniques suggest a possible directional relationship and support the importance of a positive school climate throughout the context of schooling.

First, the findings suggest grades independently changed over time. Research focused on changes in grades as students transition tends to be mixed.[89] A study by West and Schwerdt[90] using longitudinal achievement data found standardized test scores declined as students transitioned from elementary into middle school. Another study by Bellmore[91] tested the effects of interpersonal social position in schools on academic indicators. Her findings additionally demonstrated declines in early adolescent achievement over time. Alternatively, a meta-analytic review by Lee[92] suggests that the transitionary effects on middle school students are likely to cause academic achievement to stays the same (ie, plateau) instead of decline. Furthermore, a study by Akos, Rose, Orthner[93] suggests the “transition effect” is more of an interruption in student achievement growth that can be mended as students acclimate to a new school environment. This study’s findings support the general premise of this literature and provide a mild extension by being able to model changes between As/Bs, Cs, and Ds/Fs. However, a deeper understanding of specific student characteristics that may impact academic grades in this area is warranted.

Second, student perceptions of school climate declined across 3 selected sub-scales and academic groups over time. Research suggests students’ perceptions of school climate may be fluid and subject to change.[94] This study’s findings add value to using longitudinal school climate studies, as cross-sectional relationships are less likely to describe such patterns.[30] By reviewing growth model slopes, we additionally were able to better understand if changes in

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school climate occur individually and at different time points. This study's findings suggest that students' perceptions of school climate appear to diminish as a group instead of individually. However, this result was not found for the student engagement sub-scale. Practical implications of these findings may suggest that perceptions of school climate may shift due to underlying transitional modifiers.[95] The findings may also suggest conceptually different sub-scales of school climate may have added significance to students' maturity and growth. A longitudinal study by Wang and Eccles[96] outlined a multi-dimensional model that demonstrated when the school environment supports prosocial norms, students were more likely to engage in school life. This study's findings may support this position and suggest school climate is a multidimensional and socially generated phenomenon.[26,97] However, this is a mild speculation and further research is needed.

Third, perceived school climate appears to change in parallel with self-reported grades. The findings suggest students averaging As/Bs and a high positive perception of school climate maintained their academic achievement over time. Additionally, students averaging Cs/Ds/Fs with a positive school climate also demonstrated better academic grades. These findings may suggest that when positive perceptions of school climate are improved, students averaging Cs/Ds/Fs may also improve. These results are important because school climate appears to support the academic success of all students and not only the majority who tend to be less at risk.[13] If this is the case, improving students' perceptions of school climate may be a useful primary prevention strategy for large-scale school-based health promotion.[98] For example, if schools focus on improving perceptions of school climate that are supportive of health and academic-related outcomes in a collective manner, rather than separately, the results may be more impactful at the individual- and system- levels.

Fourth, although all school climate sub-scales demonstrated positive effects on academic grades, student-teacher relationships illustrated the strongest effects overall. Cross-sectional research has consistently shown nurturing relationships are a salient contributor to academic outcomes.[34,73,74] This study's results support the cross-sectional literature but also suggests that as students grow older, a positive school climate may be important for them to prospectively do well academically.[99] On the other hand, academic grades did not appear to influence school climate sub-scales except for order and safety. Among the As/Bs/Cs, academic grades demonstrated a diminishing effect on order and safety. This finding was unanticipated and further supports the dynamic interplay between school climate sub-scales and academic achievement. Similar to study findings by Peguero, Bracy,[100] these results may indicate unintended consequences with school disciplinary procedures. Studies have shown when school rules are too strict, defiance can be an unintentional result.[95] Furthermore, higher-achieving students in this sample may possess unobserved characteristics that support their unenthusiastic perception of school rules and authority. However, this concept requires further investigation.

Lastly, group comparisons from the sensitivity analysis revealed a few notable differences between middle and high school students. In the middle school only group, school climate and academic grades were found to be stable and did not significantly decline over time. This may suggest students' perceptions of school climate and academic grades stay relatively similar throughout middle school. Comparatively, high school students'

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perceptions of school climate appear to be just as important to all levels of academic achievement. However, high school students' presented much steeper declines in perceptions of school climate over time. Hence, perceptions of school climate may shift as students get older. This finding may suggest the presence of a "transition effect" as students adjust to high school.[101] Therefore, from a developmental standpoint, high school students may benefit more from subject specialization than a focus on school connection as they prepare for adulthood.[102] Although, the findings allude to the idea of transitional effects, more studies are needed to better understand how a transition between middle and high school may disrupt the social-hierarchy and impact school-based outcomes.

Conclusion

Study results demonstrated longitudinal associations between school climate and academic achievement. Findings support the value and promotion of a positive school climate, especially across sub-scales. In addition, positive perceptions of school climate may sustain high academic performance, while strengthening the grades of average and low academic performers. Given the modest variation between As/Bs, Cs, and Ds/Fs future studies should examine the mechanisms that exist between more robust models of school climate and contextual characteristics of these groups. Preliminary comparisons between middle and high school students suggest there may be differences between these groups, but further investigation is required. Future studies that support longitudinal and more generalizable findings are needed to provide recommendations for the delivery of instruction and professional practice that promotes the whole child.

Limitations

First, the sample was drawn from a predominantly homogenous group of White middle school students from 16 schools in WV. Findings may not be representative or generalizable to other regions of the United States. Second, the potential issue of non-matched students may exacerbate issues with representativeness. However, the mechanism that limits matching procedures may be difficult to distinguish. Fortunately, even when participant attrition is high, parameter estimates are still likely to be accurate.[58] Third, student self-reported information is subject to acquiescence and recall bias. Fourth, the study only modeled 3 aspects of the school climate. The literature around the school climate is diverse and considers many aspects of the socio-organizational structures of schools. However, the 3 sub-scales chosen in this study are consistently found in other school climate instruments and make-up half of the items on the SCM. Fifth, combing academic achievement into groups (ie, As/Bs) may diminish measurement sensitivity. Using measures of academic achievement as an uncombined measure may yield different information. Sixth, Mathematics and English are different subjects and therefore may also demonstrate unique independent information. However, combining these outcomes as a singular measure to represent overall academic performance is common in educational research. Seventh, maternal education may not fully represent students' SES (Berkowitz, et al[35]). Eighth, the diminished indicator sensitivity and sophisticated statistical techniques using a mixture of categorical and continuous measurement suggest caution should be used when interpreting the results. Despite this limitation, this study represents an exploration in the parallel growth of school climate and academic achievement over time. Lastly, we were unable to rule out

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unaccounted variance from other confounding variables that may substantially impact school climate sub-scales and academic grades over time.

IMPLICATIONS FOR SCHOOL HEALTH

How schools support students to achieve academic and life success will continue to be a topic for researchers and educators alike.[103] This study provides evidence that taking the time to care for students social-emotional needs does not hurt their grades, but helps them. However, non-academic factors like school climate still require research to better understand their importance to support frameworks like WSCC to achieve desired student outcomes.[104] Although this study does not account for teacher performance or classroom management, helping students achieve good grades will likely be shaped by dedicated administrators, educators, and parents but as this study's findings suggest:

- Academic grades are related to non-academic factors.
- A positive school climate, especially positive relationships with teachers, may support academic success over time.
- School climate may be used to support organizational behavior in school as a way to inform and improve academic and health promotion practice.
- Schools focused on integrating a positive school climate may increase the potential to enrich students' lives and strengthen their academic success.
- Considering average academic performers ("C" students) less important than lower performers may undermine the likelihood of a student being able to cross the achievement gap toward success.

Lastly, administrators who support and encourage teachers to form bonding relationships may help students in ways which may be evident in their academic behavior. This study's findings support this idea as students who perceived relationships with teachers as positive were as likely to sustain high academic performance compared to students with a less positive perception. In addition, school climate may support upward academic mobility for average and lower student performers. A seminal work by Allensworth and Easton[13] highlights this importance from what they deem as "personalism," (pp 32) which accounts for students' initial trust of teachers and feelings of personal support. This idea is not to infer that each student requires scheduled amounts of time to meet their needs. Rather, the authors' state:

> Teachers working together in a coordinated way—taking responsibility for the whole school; providing relevant, coherent instruction; and developing strong relationships with students—most strongly distinguishes schools with above-expected student performance in their courses.[13] (pp 33–34).

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Human Subjects Approval Statement

All aspects of each data collection year in this study, including participant involvement based on passive parental consent, were accomplished in accordance with West Virginia University's Institutional Review Board guidelines for the protection of research participants. The following are the IRB protocols for each corresponding data collection year, 2015 (# 1406345394), 2016 (# 1406345394R002), and 2017 (# 1406345394R004).

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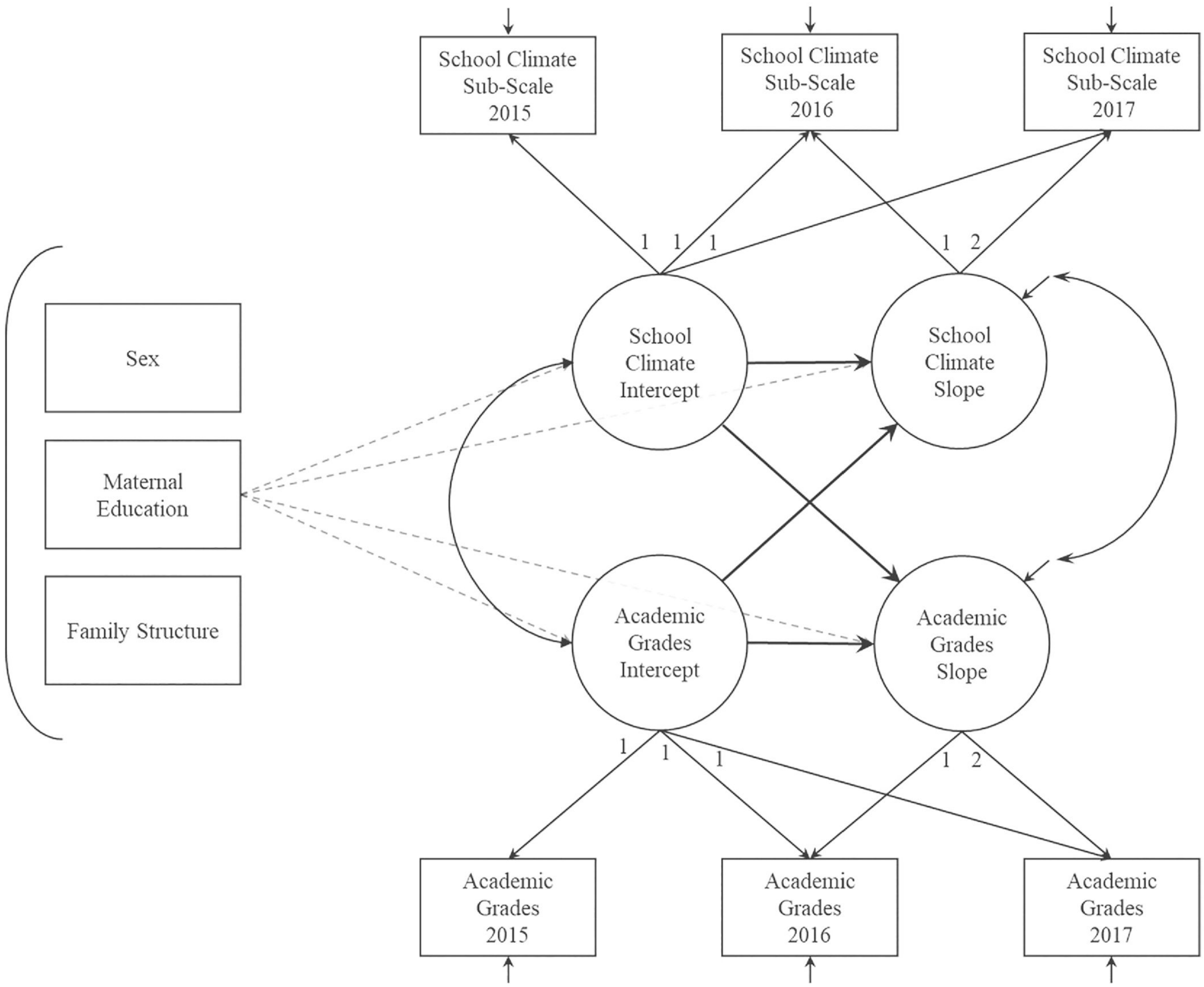

Figure 1.
Parallel Latent Growth Model for School Climate and Academic Grades

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Table 1.

Sample Frequencies, Scale Means, Standard Deviations, and Internal consistency, N = 2604

	2015		2016		2017	
Variable	**N**	**%**	**N**	**%**	**N**	**%**
Academic grades						
Mostly As/Bs	1797	80.5	1689	77.5	1702	74.9
Mostly Cs	327	14.7	362	16.6	399	17.6
Mostly Ds/Fs	106	4.8	129	5.9	171	7.5
Biological sex						
Female/male	1138/950	54.5/45.5				
Race[†]						
White/all other races	1817/280	86.7/13.3				
Maternal education						
Coll grad/HSgrad	696/615	34.2/30.2				
Less than HS/not sure	146/581	7.2/28.4				
Family structure (lives with)						
Biological parents/other arrangement	1195/902	57.0/43.0				
Scale variable	M(SD)	α	M(SD)	α	M(SD)	α
Student-teacher relationships	3.6 (0.8)	0.91	3.4 (0.9)	0.93	3.3 (0.9)	0.94
Order, safety, and discipline	3.7 (0.8)	0.85	3.6 (0.9)	0.88	3.5 (0.9)	0.90
Student engagement	3.8 (0.8)	0.86	3.7 (0.9)	0.88	3.6 (0.9)	0.89

Coll, College; HS, High School; Grad, Graduate; α, Cronbach's alpha coefficient.[105]

Missing observations were handled using pairwise techniques.

[†]Race has been included to show sample homogeneity.

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Table 2.

Parallel Latent Growth Model Intercepts, Slopes, and Unstandardized/Standardized Regression Estimates for Student Teacher Relationships, N = 2511

	Acad. Grades	SC1	As/Bs	SC1	Cs	SC1	Ds/Fs	SC1
Parameter	**B (SE)**	**B (SE)**	**B (SE)**	**B (SE)**	**B (SE)**	**B (SE)**	**B (SE)**	**B (SE)**
Intercept	0.47 (.13)**	3.42 (.06)**	0.47 (.13)**	3.42 (.06)**	−0.73 (.09)**	3.42 (.05)**	−1.86 (.21)**	3.42 (.06)**
Slope	−0.92 (.21)**	0.18 (.15)	−0.93 (.18)**	0.19 (.11)	0.33 (.11)**	0.21 (.14)	0.90 (.26)**	0.19 (.04)
Int. → slope	−0.10 (.05)*	−0.09 (.04)*	−0.11 (.06)	−0.09 (.04)*	−0.11 (.12)	−0.10 (.04)**	−0.13 (.07)*	−0.09 (.04)*
SC1 X grade	−0.01 (.01)	0.23 (.06)**	−0.01 (.01)	0.23 (.05)**	0.03 (.06)	−0.11 (.02)*	0.01 (.02)	−0.27 (.08)**
Slope ↔ slope	0.03 (.01)**		0.04 (.01)**		−0.02 (.01)*		−0.01 (.02)	
Std Est	**β (SE)**	**β (SE)**	**β (SE)**	**β (SE)**	**β (SE)**	**β (SE)**	**β (SE)**	**β (SE)**
Int. → slope	−0.33 (.16)*	−0.25 (.09)**	−0.35 (.20)	−0.25 (.09)**	−0.33 (.31)	−0.26 (.09)**	−0.48 (.24)*	−0.24 (.10)*
SC1 X grade	−0.08 (.07)	0.30 (.08)**	−0.09 (.06)	0.27 (.08)**	0.10 (.06)	−0.20 (.01)*	0.04 (.12)	−0.45 (.11)**
Slope ↔ glope	0.28 (.13)*		0.30 (.10)**		−0.29 (.15)*		−0.09 (.23)	
−2LL (FP)	24,558.14(29)		22,978.26 (28)		22,978.26 (28)		19,786.04 (28)	
AIC/BIC	24,616.14/24,785.17		23,034.26/23,197.46		22,584.06/22,747.26		19,842.04/20,005.24	

** $p < .01$

* $p < .05$.

−2LL, Deviance, FP, Free Parameters, Std. Est., Standardized Estimate, SC1, Student-Teacher Relationships, Int., Intercept, Acad. Grades, Academic Grades.

Estimates include covariates and pairwise adjustment. School Clusters = 16.

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Table 3.

Parallel Latent Growth Model Intercepts, Slopes, and Unstandardized/Standardized Regression Estimates for Order and Safety, N = 2512

	Acad. Grades	**SC2**	**As/Bs**	**SC2**	**Cs**	**SC2**	**Ds/Fs**	**SC2**
Parameter	B (SE)	B (SE)	B (SE)	B (SE)	B (SE)	B (SE)	B (SE)	B (SE)
Intercept	0.47 (.12)**	3.64 (.06)**	0.47 (.18)**	3.64 (.06)**	−0.74 (.18)**	3.64 (.05)**	−1.89 (.22)**	3.64 (.06)**
Slope	−0.96 (.25)**	0.28 (.18)	−0.90 (.25)**	0.28 (.19)	0.27 (.14)*	0.30 (.19)	0.98 (.26)**	0.27 (.19)
Int. → slope	−0.09 (.04)*	−0.11 (.05)*	−0.11 (.06)	−0.12 (.05)*	−0.12 (.05)	−0.12 (.04)**	−0.14 (.06)*	−0.11 (.05)*
SC2 X grade	−0.02 (.01)	0.23 (.07)**	−0.02 (.01)*	0.21 (.07)**	0.04 (.02)*	−0.09 (.04)*	0.01 (.02)	−0.27 (.07)**
Slope ↔ slope	0.03 (.01)*		0.03 (.01)*		−0.02 (.01)		−0.01 (.02)	
Std Est	β (SE)	β (SE)	β (SE)	β (SE)	β (SE)	β (SE)	β (SE)	β (SE)
Int. → slope	−0.31 (.16)*	−0.25 (.09)**	−0.36 (.20)	−0.25 (.09)**	−0.32 (.31)	−0.25 (.09)**	−0.55 (.26)*	−0.25 (.04)**
SC2 X grade	−0.10 (.05)	0.29 (.09)**	−0.11 (.05)*	0.24 (.01)**	−0.15 (.07)*	−0.16 (.08)*	−0.01 (.04)	−0.46 (.11)**
Slope ↔ slope	0.25 (.11)*		0.25 (.11)*		−0.23 (.17)		−0.15 (.22)	
−2LL (FP)	24,681.74(29)		23,104.74(28)		22,650.31 (28)		19,902.18 (28)	
AIC/BIC	24,739.74/24,908.77		23,160.74/23,323.94		22,706.31/22,869.51		19,958.18/20,121.38	

** $p < .01$

* $p < .05$.

−2LL, Deviance, FP, Free Parameters, Std. Est., Standardized Estimate, SC2, Order and Safety, Int., Intercept, Acad. Grades, Academic Grades.

Estimates include covariates and pairwise adjustment. School Clusters = 16.

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Table 4.

Parallel Latent Growth Model Intercepts, Slopes, and Unstandardized/Standardized Regression Estimates for Student Engagement, N = 2512

	Acad. Grades	SC3	As/Bs	SC3	Cs	SC3	Ds/Fs	SC3
Parameter	**B (SE)**	**B (SE)**	**B (SE)**	**B (SE)**	**B (SE)**	**B (SE)**	**B (SE)**	**B (SE)**
Intercept	0.48 (.12)**	3.72 (.05)**	0.47 (.13)**	3.72 (.05)**	−0.73 (.09)**	3.72 (.05)**	−1.90 (.22)**	3.72 (.06)**
Slope	−0.75 (.25)**	0.35 (.13)**	−0.77 (.24)**	0.35 (.13)**	0.35 (.30)**	0.36 (.14)**	0.63 (.30)*	0.33 (.09)*
Int. → slope	−0.09 (.05)*	−0.14 (.03)**	−0.11 (.06)	−0.14 (.03)**	−0.11 (.12)	−0.14 (.03)**	−0.14 (.07)*	−0.14 (.03)**
SC3 X grade	−0.01 (.01)	0.16 (.07)*	−0.01 (.01)	0.17 (.06)**	0.02 (.02)	−0.11 (.04)**	−0.01 (.02)	−0.17 (.08)*
Slope ↔ slope	0.03 (.01)**		0.03 (.01)**		−0.01 (.01)		−0.02 (.02)	
Std Est	**β (SE)**	**β (SE)**	**β (SE)**	**β (SE)**	**β (SE)**	**β (SE)**	**β (SE)**	**β (SE)**
Int. → slope	−0.32 (.16)*	−0.29 (.06)**	−0.35 (.20)	−0.30 (.06)**	−0.33 (.30)	−0.30 (.06)**	−0.54 (.02)*	−0.29 (.06)**
SC1 Xdrug	−0.03 (.06)	0.22 (.09)**	−0.04 (.06)	0.20 (.08)**	0.06 (.07)	−0.19 (.07)**	−0.03 (.10)	−0.30 (.13)*
Slope ↔ slope	0.26 (.10)**		0.24 (.10)*		−0.15 (.15)		−0.29 (.18)	
−2LL(FP)	24,587.87 (28)		23,008.97 (28)		22,550.21 (28)		19,808.34(28)	
AIC/BIC	24,645.87/24,814.90		23,064.97/23,228.17		22,606.21/22,769.42		19,864.34/20,027.55	

** $p < .01$

* $p < .05$.

−2LL, Deviance, FP, Free Parameters, Std. Est., Standardized Estimate, SC2, Order and Safety, Int., Intercept, Acad. Grades, Academic Grades.

Estimates include covariates and pairwise adjustment. School Clusters = 16.