

# Student Background, School Climate, School Disorder, and Student Achievement: An Empirical Study of New York City's Middle Schools

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## ARTICLES

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# Student Background, School Climate, School Disorder, and Student Achievement: An Empirical Study of New York City's Middle Schools

Greg Chen  
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**ABSTRACT.** This study develops and tests a school disorder and student achievement model based upon the school climate framework. The model was fitted to 212 New York City middle schools using the Structural Equations

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Modeling Analysis method. The analysis shows that the model fits the data well based upon test statistics and goodness of fit indices. The model accounts for 82% of the variance of student achievement scores on state standardized examinations. The study supports the model hypothesis that poverty and minority status of student population predict school disorder. Lower level of student SES is also associated with lower level of academic achievement directly, and indirectly mediated through school disorder. School disorder affects student academic achievement directly and indirectly mediated by student attendance rate. The effect of school size is in the hypothesized direction, i.e., smaller schools tend to have lower disorder and higher learning. Nevertheless, the effect is small and statistically insignificant, after controlling for student background and school culture variables in the model. The evidence of the study implies that school culture as reflected in school disorder and student attendance hold great potential for improving student learning. The reduction of school size, as currently used by many school districts to improve student learning, may prove to be ineffective if applied alone. In the large context and in the long run, reducing urban poverty will help close the gap between high and low achieving schools.

**KEYWORDS.** Middle school, student achievement, school violence, school safety, school disorder

The issue of school disorder and student academic achievement is of great concern to students, parents, educators, and policy makers (National Center for Educational Statistics, 2003). This is especially true in large urban areas, where poverty and minority concentration coexist. For example, 709 crimes were reported in 16 New York City Schools in the 03–04 schools year, which has triggered a major safety program in the city (Bloomberg, 2005). Only 52 % of high school students graduate in time from the New York City school system (Klein, 2006), causing major concerns from citizens, educators, and the city government alike.

School disorder and student academic achievement are correlated theoretically. A safe school is a prerequisite for students to concentrate their energy in learning related activities. Conversely, fear and avoidance can be a major factor in affecting student participation in school activities and therefore negatively affect student learning. Moreover, many other contextual, input, and process variables also affect school disorder and student achievement. Student background, especially social economic status, has been reported to affect student behavior and student learning.

Empirically, comprehensive studies of school disorder and student achievement in the large school and community context are however limited. Most of the studies are exploratory, considering one variable at a time. The present study intends to develop and test a school disorder and student achievement model, which incorporates key student background, school structure and culture variables based on school climate theory, using the confirmative, Structure Equation Modeling (SEM) technique. The study employs school level data from New York City, the largest urban school district in the United States.

This paper is organized into five sections. After the introduction, the paper provides a brief literature review of previous works in the field. This is followed by the conceptualization and specification of the model in terms of constructs and relationships. The paper then describes the data, variables, and analytical techniques. The results of the analysis are then presented and discussions extended. The paper concludes by discussing the study's policy implications, limitation, and direction for future research.

## ***LITERATURE REVIEW***

Many sociological, psychological and educational studies of school disorder and student achievement have been reported in the literature (Clark & Lab, 2000; Hellamn & Beaton, 1986; Kramer, 2000; Lee, 2000; Morrison, 2001; Moses, 1999; Schreiber, 2002; Stretesky & Hogan, 2005; Welsh, 2003). Students' socio-economic (SES) and demographic characteristics relate to antisocial behavior and therefore affect school disorder (Fleming, Barner, Hudson, & Rosignon-Carmouche., 2000). Specifically, poverty, minority status, and degree of resident mobility have been found to be negatively associated with school safety (Anderson, 1998; Gottfredson & Daiger, 1979; Mateu-Gelabert, 2003; Toby, 1983). Student characteristics also affect student school performance. Student socio-economic status (SES) accounts for the single largest proportion of student academic achievement variance among all other student and school variables in school effects studies (Caldus, 1993; Lee, 2000; Rutter, 1983).

Schools exert an effect on student behavior and achievement. School climate concept has played a central role in school effectiveness studies. Although no single definition of school climate is accepted by all, it often refers to the impressions, beliefs, and expectations held by members of the school community about their school as a learning environment, their

associated behavior, and the symbols and institutions that represent the patterned expressions of the behavior (Gottfredson, Gottfredson, Payne, & Gottfredson 2005; Payne, Gottfredson, & Gottfredson, 2003; Welsh, 2000; Welsh, 2003; Lee, 2000). Two key components of the school climate concept are school structure and school culture (Anderson, 1982). School structure can be measured through class size and school enrollment (Welsh, Stokes, & Greene, 2000). Variables such as large school enrollment and high student to teacher ratios have been associated with disorder in schools (Duke, 1989; Gottfredson & Gottfredson, 1985; Toby, 1983). Theoretically, large schools may create an environment of impersonality and anonymity (McPartland & McDill, 1977). However, large schools may also provide more specialized resources and comprehensive programming that tailor to the diverse needs of the students (Conant, 1967). Whether school size affects student behavior and achievement is an empirical question. Although the majority of studies have reported negative relationships between school size and student behavior and student academic achievement, the relationships have not been consistently reported in all the investigations (Schreiber, 2002; Lee, 2000; Lee & Smith, 1997; Lamdin, 1995; Caldas, 1993; Rutter, 1983; Conant, 1967). Borland and Howsen (2003) found that school size has a nonlinear relationship with respect to student achievement. They reconcile their findings with previous studies by claiming that earlier studies have not fully controlled for student ability, which reflects on student characteristics and family background.

School culture can be measured by student attendance (Welsh, Stokes, Greene, 2000) and attendance rate is of great importance to student learning theoretically (Lamdin, 1996). Limited empirical studies suggest that student attendance affects student academic performance (Caldas, 1993). Higher attendance predicts greater learning when controlling for poverty, ethnic composition, school and class size, and per pupil expenditure (Lamdin, 1996).

School disorder affects student achievement directly through disruption of instruction and distraction of student energy from learning due to safety concerns (Anderson, 1998; Bowen & Bowen, 1999; Casella & Burstyn, 2002; Grogger, 1997; Gronna & Chin-Chance, 1999; Hanson, Austin, & Lee-Bayha 2003). School disorder also affects student achievement indirectly mediated by student attendance. Students may choose not to come to school when they perceive that their safety is threatened (Bowen & Bowen, 1999). Perception is at least as important as reality in influencing student participation behavior. Unsafe schools may invoke fear and dissuade students from coming to school, therefore depriving the opportunity for students to learn (Sorenson & Hallinan, 1977).

Welsh et al., (2000), developed a model for school disorder, which connects student background, community crime rate, school size, and student attendance rate with school disorder. The study shows that poverty exerts a strong indirect effect on school disorder. The effects of community variables on school disorder are strongly mediated by school stability as measured by student attendance rates and transfer rates. School climate does affect student behavior, consistent to the finding in school effects studies.

## ***CONCEPTUAL FRAMEWORK***

This study postulates and tests a School Disorder and Student Achievement Model, wherein school safety and student achievement, the two key outcome measures in education, are connected. The model builds upon the School Disorder Model (Welsh et al, 2000) and extends it to include student academic achievement. Specifically, it hypothesizes:

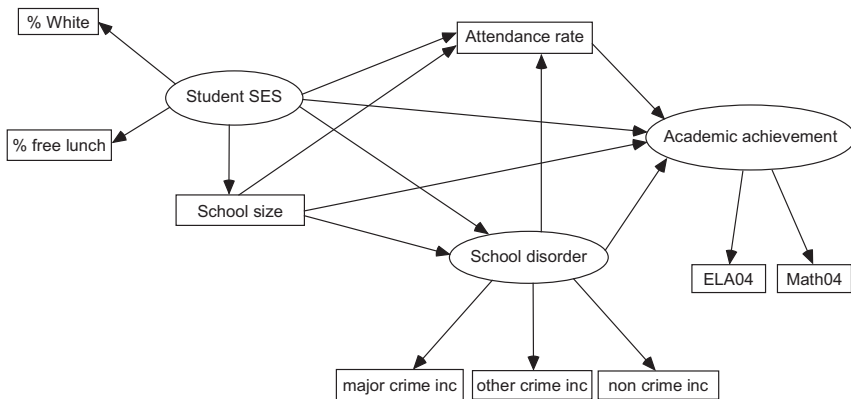
- I. Higher levels of student socio-economic status predict lower levels of school disorder and higher levels of attendance rate. Student socio-economic status also exerts a positive indirect effect on student academic achievement mediated by school disorder and student attendance rate.
- II. Larger school size predicts higher school disorder and lower attendance rates. School size has an indirect negative effect on student academic achievement mediated by school disorder and student attendance rate.
- III. School culture, as measured by student attendance rate, has a direct positive effect on student achievement. The higher the student attendance rate, the higher the student academic performance.
- IV. School disorder has a direct effect on student achievement and an indirect effect on student academic achievement mediated by student attendance rate. School disorder reduces student attendance, which in turn lowers academic achievement.

A graphical illustration of the model is presented in Figure 1.

## ***DATA AND METHOD***

The data for the present study were originated from the New York City Department of Education. A copy of cleaned and summarized data

FIGURE 1. Path diagram of school safety and student achievement model.



was obtained from the Institute for Education and Social Policy (IESP) of New York University. To strengthen the causal argument, the 2002-03 and the 2003-04 school year data for all the middle schools were obtained and included in the study. It is reasoned that using 2002-03 school year of school climate data to model 2003-04 school year student academic performance enhance the internal validity of the confirmative study.

New York City presents an excellent opportunity to study the complex relationships among student backgrounds, school climate, school disorder, and student achievement. The New York City public school system is the largest urban district in the country. It represents the concentration of poor and minority students in urban schools with wide ranges of crime, violence, and student academic achievement (Mateu-Gelabert, 2003).

The selection of middle schools is due to the fact that middle schools witness more school disorder (Miller & Chandler, 2005). Middle school students are more susceptible to school influence, including school climate, than their counterparts in high schools. The selection is also partly due to the consideration that middle schools experience substantial violence and crime. Arguably, it is of greater interest for educators and policy makers to learn about crime in middle school so that appropriate policy intervention could be implemented before the students move on to their senior years.

There were 223 middle schools in New York City in the 2003-04 school year, based on New York City Department of Education classification.

Among them, 11 schools have missing data on major variables to be considered in this study. They were subsequently deleted from the dataset. The final data therefore includes 212 schools, representing 96% of all middle schools in New York City.

## ***VARIABLES***

The study variables are derived from the school safety and student achievement model. They fall under four major constructs: student background, school climate, school disorder, and student achievement. These constructs and the measured variables are described further below.

### ***Student Population Social and Economic Status***

The study includes two key measures of student characteristics, poverty level and ethnic composition, which have documented effects on student behavior and academic achievement. Student poverty level is measured by the percentage of student population eligible for free lunch; student ethnic composition is measured by the percentage of white students. The two variables were anticipated to be highly correlated, reflecting the fact that minorities make less income on average than the majority population. Nevertheless, these two variables do reflect different aspects of student body characteristics in a school and it was anticipated that to some limited extent, each variable will contribute independently to the explanation of endogenous variables in the model. To prevent the future difficulties in interpreting study results due to multicollinearity, while tapping into the variance of the two important but highly related variables, a latent factor, Student Social Economic Status (SES), was created to represent student racial and economic conditions and used in the model specification and testing.

### ***School Climate***

School climate is represented in the model by two key concepts, school structure and school culture and operationalized by two variables, school size and student attendance rate respectively. School size is measured by the number of students enrolled at each school. Student attendance rate is measured by the average percentage of days students come to school for the 2003-04 school year.



### ***School Disorder***

The school disorder factor, although part of the large school climate construct is discussed separately in the study for its importance. It is comprised of three categories of student behavioral incidences: major crime, minor crime, and non-crime incidences. These data are collected and reported by police of the New York City Police Department, who reside on campus and are responsible for school safety for the 2002-03 school year. As in other criminal justice systems, the incidents are reported on a per 1000-student population basis.

### ***Academic Achievement***

Student academic achievement construct is composed of school mean scores on two key subject areas in schools, the Grade 8 English Language Arts (ELA) and the Grade 8 Mathematics (Math) of the New York State Examinations for the 2003-04 school year. These school averages are deemed the best indicators of student learning and academic achievement, albeit with the innate limitations of standardized testing. The two key measures combined reflect on the student academic achievement construct, the latent outcome measure, of the school disorder and student achievement model.

### ***Analytical Framework***

The Structural Equation Modeling method (SEM) was selected and employed as the main analytical technique for the study. The SEM is confirmatory and handles latent factors well. The SEM facilitates the test of theoretical constructs and can render evidence of causal interpretations. Although a fundamentally variance and covariance structure analysis method in nature, the SEM does provide a framework to test hypothesized models, especially when lagged data, i.e., the 2002-03 and the 2003-04 data, are available and used as in the present study.

Moreover, the SEM method allows the research to specify and test models of complex relationships. It solves multiple equations simultaneously where the dependent variable in one equation can function as an independent variable in another equation. This helps to test plausible mechanisms, through which significant input or mediating constructs interact to produce the outcomes. Furthermore, SEM often provides a path diagram with good readability and interpretability. The alternative of

treating multivariate data is the traditional multiple regression. When dealing with systems as complex as schools, multiple regressions become cumbersome in terms of process and interpretation, especially when multicollinearity is present. By treating outcome variables individually, the multiple regression approach generates many regression models. The internal relationships and the mechanism through which the input and mediating variables affect each other and the outcome variables are difficult, if at all possible, to decipher.

Two statistical software packages were used in the analysis. SPSS was used to conduct descriptive and bivariate analysis. AMOS5 was used for the SEM analysis. AMOS is selected for this analysis over SPSS for its convenience as it can provide model fit statistics directly. Moreover, AMOS generates high quality path diagrams, which with very limited modification, can be used as figures in reports and publications (Byrne, 2001).

## ***RESULTS AND DISCUSSION***

### ***Descriptive Statistics***

The descriptive statistics of the study variables are presented in Table 1. As shown in the table, the schools and the student populations in the schools are highly diverse. The schools vary in size from 164 to 2,262 students. Close to three quarters of the students in the study schools are eligible for free lunch. African Americans and Hispanics account for the majority of the student population. The racial

TABLE 1. Descriptive statistics of study variables

	N	Minimum	Maximum	Mean	Std. Dev.
School size (School enrollment)	213	164	2262	959.65	493.40
% Eligible for free lunch	213	9.30	100.00	71.42	22.83
% White	213	.00	88.80	13.26	19.34
# Major crime incidents	213	.00	9.00	1.52	1.74
# Other crime incidents	213	.00	26	7.68	5.75
# Noncriminal incidents	213	.00	126	13.57	16.24
Attendance rate (% days students attended)	213	84.20	97.00	91.53	2.69
ELA04 (Mean score, State ELA)	212	660.40	741.20	691.14	15.37
Math 04 (Mean score, State Math)	213	659.20	763.40	706.18	20.59

composition of the student population varies substantially among the schools in the sample. The percentage of white students ranges from zero to 88 %.

The schools witnessed substantial level and variance in crime and other delinquency incidence in the 2003-04 school year. On average, the police reported 1.5 major crime incidents per 1,000 students across the schools with a standard deviation of 1.75. A typical school reports 7.7 other crimes with a standard deviation of 5.7. Non-crime incidences count for student misconduct in schools. While some schools do not have such incidences regularly, others experience 126 incidents per year reportable to the police.

There are also large variances in student attendance rates. Although the average attendance rate in all the schools in the sample is reasonably high of 92 %, it varied from a low of 84 % to a high of 97 % within the study schools.

The descriptive statistics of student achievement information also reveal that schools differ substantially in average student achievement as measured by mean examination scores. The school mean scores on ELA ranged between 660 and 741 with an overall grand mean for New York State of 691. The school mean scores on Math varied between 659 and 763 with an overall grand average of 706 (New York State Department of Education, 2004).

### ***Zero Order Correlations***

The bivariate correlations are presented in Table 2. These statistics provide an overview of the relationships among the study variables and they are the raw material to be fed to SEM for multivariate analysis. As shown in Table 2, patterns of zero-order correlations exist among many pairs of study variables. Student minority status and eligibility of free lunch are highly and not totally correlated. This provides justification for the use of the latent factor of Student SES, which allows the inclusion of both variables while obviating the threat of multicollinearity. Notwithstanding, large correlations are found between student SES variables and school disorder measures; between student SES variables and student achievement indicators; between school size and some of the school disorder variables; between school disorder and student attendance rate; and between school disorder and student achievement measures. These correlations provide the foundation for the ensuing structural equation modeling.

TABLE 2. Zero order correlation of study variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
School size (1)	1								
% Eligible for free lunch (2)	-.088	1							
% White (3)	.134	-.776(**)	1						
# Major crime incidents (4)	.032	.207(**)	-.240(**)	1					
# Other crime incidents (5)	.170(*)	.304(**)	-.292(**)	.464(**)	1				
# Noncriminal incidents (6)	.082	.267(**)	-.274(**)	.308(**)	.661(**)	1			
Attendance rate (7)	.042	-.576(**)	.482(**)	-.248(**)	-.468(**)	-.477(**)	1		
Mean score, State ELA (8)	.057	-.734(**)	.622(**)	-.248(**)	-.474(**)	-.451(**)	.798(**)	1	
Mean score, State Math (9)	.049	-.663(**)	.572(**)	-.278(**)	-.516(**)	-.472(**)	.811(**)	.929(**)	1

\*Correlation is significant at the 0.05 level (2-tailed).

\*\*Correlation is significant at the 0.01 level (2-tailed).

## RESULTS FROM STRUCTURAL EQUATION MODELS

The analysis indicates that the model fits the data very well. The Chi-square test statistic of the overall model is insignificant ( $p = 0.06$ ), suggesting no statistical grounds to reject the model. The comparative fit index (CFI) for the model is 0.99, far exceeding the required 0.90 acceptance level (Bentler & Chou, 1987; Hoyle, 1995). The absolute measure of model fit as measured by RMSEA is 0.05, which is smaller than the 0.08 standard (Browne & Cudeck, 1993; Wendorf, 2002). The model accounts for 82% of variance in school average student achievement, the ultimate outcome construct of the model. The parameter estimates of the SEM are presented in Figure 2 and Table 3. Figure 2 provides the standardized path coefficient and the variances explained for key outcome variables. Table 3 provides the non-standardized coefficients and the corresponding  $p$ -value for test statistics.

The parameter estimates of the SEM analysis provide support for Hypothesis I that higher levels of student SES predicts higher levels of school disorder, lower levels of student attendance rate, and a lower level of student academic achievement mediated by school disorder and student attendance rate. The coefficient leading from Student SES to student attendance rate is positive and significant ( $\beta = 0.43$ ,  $p < 0.001$ ). The

FIGURE 2. Path diagram and estimated parameters of the school safety and student achievement model.

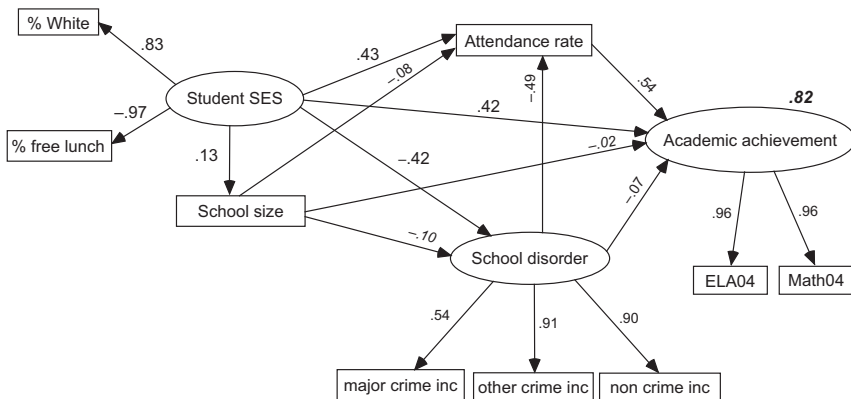


TABLE 3. Regression weights of endogenous variables in SEM

		Variables	Estimate	S.E.	P
Attendance rate	←	Student SES	0.065	0.009	***
School disorder	←	Student SES	-0.02	0.004	***
School disorder	←	School size	0	0	0.149
Attendance rate	←	School size	0	0	0.097
Attendance rate	←	School disorder	-1.564	0.261	***
Academic achievement	←	School disorder	-1.388	0.995	0.163
Academic achievement	←	School size	-0.001	0.001	0.586
Academic achievement	←	Attendance rate	3.196	0.348	***
Academic achievement	←	Student SES	0.377	0.046	***

\*\*\*Regression weight is significant at the 0.001 level (2-tailed).

higher the level of Student SES, the higher the level of student attendance. The coefficient leading from Student SES to school disorder is negative and significant ( $\beta = -0.42$ ,  $p < 0.001$ ). The higher the level of Student SES, the lower the level of school disorder. Consistent to previous studies, there is a direct effect of Student SES on student achievement ( $\beta = 0.42$ ,  $p < 0.001$ ). A higher level of SES predicts higher levels of student performance on standard examination scores in English Language and Math.

There is also an indirect effect of Student SES, as an input or client characteristic, primarily through the mediation of student attendance ( $\beta = 0.54$ ,  $p < 0.001$ ). The total effect of Student SES on student academic performance can be calculated by combining the direct effect 0.42 and indirect effect 0.23 ( $0.43 * 0.54$ ). The total effect of Student SES on student achievement is therefore calculated to be 0.65.

The coefficients leading from school size to school disorder ( $\beta = -0.10$ ,  $p = 0.149$ ) and the coefficients from school size to student academic achievement ( $\beta = -0.02$ ,  $p < 0.586$ ) are consistent with the predictions of Hypothesis II, but are not statistically significant. Hypothesis II, that larger school size predicts higher school disorder and lower attendance and that school size has also an indirect effect on student academic achievement mediated by school disorder and student attendance rate, cannot therefore be confirmed. The result is nevertheless consistent with the previous studies that report inconsistent findings between school size and student performance. The effect of school size is small and often insignificant in affecting school safety and student performance.

The study provides evidence to support Hypothesis III that student attendance has a direct positive effect on student achievement ( $\beta = 0.54$ ,

$p < 0.001$ ), controlling for student input, school size, and the level of school disorder. This is in correspondence to Lamdin' finding (1996) that attendance affects student academic performance positively. Attendance as part of the school climate can be influenced by school policies and school operation. A communal school, emphasizing trust, understanding, and participative decision-making, among other things, can attract and bond students even in urban poverty laden communities (Payne et al., 2003).

The study provides partial support for Hypothesis IV, that school disorder affects student achievement directly and indirectly through student attendance rate. The direct effect is in the predicated direction, but statistically insignificant ( $\beta = -0.07$ ,  $p < 0.163$ ). The indirect effect mediated by attendance rate is calculated to be  $-0.26$  (product of the effect of school disorder on attendance rate of  $-0.49$  multiplied by the effect of student attendance rate on student academic achievement of  $0.54$ ). School disorder has a significant effect on student achievement, although the mechanism of the impact suggests a mediating route, i.e., through its effect on student attendance.

Attendance as a measure of school culture seems to demonstrate importance in affecting student achievement and in mediating other factors within the school and outside the school systems. In addition to the significant direct effect, the students' attendance rate mediates the effects of school disorder, which is under the control of school administration, as well as student population minority status and level of poverty, which is often beyond the reach of the school systems. This supports the school climate and school effect concepts. School disorder distracts student attention and energy to learning activities. When schools are perceived unsafe, students respond by avoiding the schools. The lowered attendance rate further deprives students the opportunity to learn in a socially conducive environment.

### ***POLICY IMPLICATIONS***

The present study confirms the previous knowledge that student background, especially poverty and racial composition, affects student behavior and academic achievement. It is therefore imperative for policy makers and the society at large to address the issue of poverty and disparity, which is worsening in many urban communities in recent years.

The study supports the school disorder and student achievement model, wherein school disorder affects student academic achievement while taking into account the influence of the communities. Learning takes place better in a safe, especially perceived safe, environment. It is therefore reasonable

to suggest that schools should use proven effective policies and programs to combat school disorder and violence in the short run. To that end, police presence, metal detectors, and surveillance programs as currently being developed and implemented in many New York City schools are necessary as the first step. These programs can potentially have an immediate effect through controlling access and monitoring activities, as well as responding to incidents before they become crises (Gottfredson et al., 2000). However, programs that are invasive and that unduly heighten the perceived danger should be used with caution. Fear of victimization, or even rejection in principle to these practices, could reduce attendance and therefore indirectly and negatively affect student learning (Hanson et al., 2003).

School climate measures, especially student attendance, play a significant role in mediating the effect of school disorder on student achievement. To improve school climate, school leadership may consider policies and management styles that promote participation, trust, and understanding. School safety programs that address and appeal to student value, cognition, and social skills may have great potential for long lasting results (Wilson & Lipsey, 2005). Effective programs, such as Environmental Competence in Guardianship (Gottfredson et al., 2000), FAST track-Family and school together/PATHS program (Astor, Meyer, Benbenishty, Marachi, & Rosemond, 2005), and communal organization/student bonding programs (Payne et al., 2003) could be implemented to address student behavior and therefore improve student academic achievement.

The present study does not lend strong support to current policy initiatives in reducing school size. Although in the right direction, the link between school size, student behavior, and learning are tenuous and not statistically significant. Further investigation in the local setting is recommended.

### ***LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH***

Although effort has been made to improve the internal validity of the study, by using two consecutive years of data and by employing causal modeling techniques, i.e., the SEM analysis, the study suffers a number of limitations common to empirical social science studies. First, it uses school level data, which cannot uncover individual differences among students. Second, the study focused on the urban New York City school district, which limit its external validity in generalizing the results to dissimilar communities. Moreover, the study presumes a directional



effect leading from school disorder to student achievement. Arguably, an equally plausible relationship could be made that lower academic performance may lead to school disorder, although this question can be better addressed by student level data. Further investigation, using multi-level, longitudinal, or experimental data and further extended reciprocal models to address school disorder and student learning can prove to be fruitful.

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