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ABSTRACT

This paper reports on a statewide study that examined the extent to which a safe school influences individual student achievement. The study used a two-level hierarchical model that included student characteristics and school conditions used in prior research. The statewide analysis was based on 46 of the 50 schools with grade 8 classes in one western state. The study used scores from the Stanford Achievement Test, along with data obtained from state department of education data bases for the school years 1993 through 1996. The findings suggest that school safety has statistically significant effects on students' grade 8 reading and mathematics achievement. Controlling for student background characteristics and differences in school conditions, students who are in safer schools have higher grade 8 achievement scores than students who are in less-safe schools. The results suggest that schools with lower levels of school violence provide better learning environments for students in middle-level schools. Additionally, there was a statistically significant negative effect on student achievement associated with increased school disciplinary infractions after controlling for student background characteristics and school conditions. Since students who are in safer schools have higher grade 8 achievement scores than students who are in less-safe schools, school safety should receive increased attention from policymakers. (Contains 39 references.) (RJM)

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Effects of School Safety and School Characteristics on Grade 8 Achievement: A Multilevel Analysis

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Abstract

Issues of school safety are a national concern (National Education Association, 1998). Creemers' (1994) multilevel model of educational effectiveness was the framework for this study which focused on the influence of school safety on individual student achievement. This state-wide study used a two-level hierarchical model that included student characteristics and school conditions within Creemers' (1994) theoretical framework. The findings of this multilevel study suggest that school safety has statistically significant effects on students' Grade 8 reading and mathematics achievement. Controlling for student background characteristics and differences in school conditions, students who are in safer schools have higher Grade 8 achievement scores than students who are in less safe schools.

The results suggest that schools with lower levels of school violence provide better learning environments for students in middle-level schools. The researchers conclude the maintenance of a safe learning environment, measured by indicators of school disciplinary infractions, have a statistically significant effect on students' Grade 8 achievement. There was a statistically significant negative effect on student achievement associated with increased school disciplinary infractions after controlling for student background characteristics and school conditions.

The results suggest that school safety receive increased attention from policymakers because of its impact on student learning. From this research, it is obvious that some school contexts are more difficult places in which to learn, and this has a measurable impact on students' achievement. Future research should continue to examine how safety affects school processes and improvement efforts.

Effects of School Safety and School Characteristics on Grade 8 Achievement: A Multilevel Analysis

Issues of school safety are of current national and local interest in Hawaii (National Education Association, 1998; Violence Prevention Coordinating Council, 1995). Educators, parents and students are concerned about the increased levels of violent incidences within schools and ensuing repercussions upon student performance. Children living with danger often develop defenses against their fears and these fears interfere with their development as energy spent on these defenses is not available for learning (Prothrow-Stith & Quaday, 1995). Researchers have recently examined school safety conditions and have considered the influence of bullying, gang violence, and violent activities within schools upon student outcomes (Baker, 1996; Chesney-Lind et al., 1995; Eccles, Lord, & Midgley, 1991; Furlong, Chung, Bates, & Morrison, 1995; Kimweli & Anderman, 1997; National Center for Educational Statistics, 1995).

Furlong and his colleagues (1995) found that students who had been victims of violence had lower grades and higher levels of perceived danger within schools than their non-victim peers. The researchers suggest that high levels of school violence may have a "generalized retarding effect on a child's development and overwhelm coping and protective factors naturally present in the student's life" (pp. 294-295). Kimweli and Anderman (1997) concluded that students enrolled in violent schools are exposed to unpredictable events not under the student's control and found that smaller schools had lower levels of violence.

Based on the finding that extreme violence has been found to hinder cognitive, social, and emotional development (Furlong et al., 1995; Harris, 1995; Prothrow-Stith & Quaday, 1995), one can argue that an unsafe school environment would hinder academic achievement. In more violent schools, students have less time to focus on academic activities as they are concerned about other factors and personal safety issues (Kimweli & Anderman, 1997; Prothrow-Stith & Quaday, 1995).

The review of the literature, however, did not uncover any study that addressed the influence of school safety conditions on student achievement. The safety characteristics of a school might explain

some of the variance in student achievement between schools. Students in schools with high levels of violence will be more apprehensive about their safety, distracted by violent events within classrooms and the school, and place a lower level of importance on components of learning than students in "safe" middle-level schools (Kimweli & Anderman, 1997). Because students within "safe" schools are not worried about victimization they presumably have more time to devote to academic activities. Educators in "safe" schools would also be able to devote more time to teaching and less time disciplining students.

This study addressed one main issue: To what extent does the maintenance of a safe school influence individual student achievement? This research incorporated school-level conditions of safety within a theoretical educational effectiveness model to examine student-level achievement within and between various schools.

Numerous studies conducted over the past two decades in diverse settings have concluded that schools exhibit characteristics that differentially affect student achievement (e.g., Fowler & Walberg, 1991; Hanushek, 1989, 1997; Heck & Mayor, 1993; Witte & Walsh, 1990). Because of the diversity of theoretical formulations, operational definitions of variables, unit of analysis problems, and other technical issues present in the diverse body of studies, it has made integration of the knowledge difficult. A challenge has been how to incorporate the findings of these diverse studies into a theoretical model that explains how contextual factors, student background factors, and school process interact to produce student learning.

Creemers' (1994) model of educational effectiveness is one such attempt to specify a theoretical model that can account for the findings of individual studies. Creemers' (1994) four-level model of educational effectiveness includes contextual-level, school-level, classroom-level and student-level characteristics. While the conceptual components of Creemers' (1994) theory have been laid out, testing the theory has proven problematic until more recently. Influences on student learning represent a "nested" data set, because of the effects of successive levels of the organization. At the micro level are variables that directly affect students (e.g. previous learning and other background factors). Students are nested in

classrooms—that is, they are grouped in a variety of ways that result in similar experiences (a similar teacher, curriculum activities). Moreover, classes are nested in schools, and schools may also be nested in communities or districts. All of these successive macro levels may exert influences on students.

Because the effects on students are multilevel, Creemers (1994) supports the use of a newer type of analysis, called multilevel analysis, to ensure the proper estimation of the effects of successive layers of the macro context on student learning. Through such multilevel models, one may estimate the proportion of variance explained by various levels within educational systems on student achievement. Given the scope of Creemers' (1994) educational effectiveness framework, it provides a useful means for organizing and understanding the factors within and between schools that influence student learning. The influence of school safety on student achievement can thus be examined within a framework that allows the researcher to more accurately control for differences in student and school characteristics.

Largely ignored in previous studies of school effectiveness are middle schools. This is a glaring omission, because middle level schools are of critical educational interest, as many are cognizant of the academic challenges during these grades. Previous work on middle-level schooling provides broad support for Creemers' (1994) model of educational effectiveness. Prior achievement has consistently been the best predictor of Grade 8 achievement (Bruce & Singh, 1996; Keith & Benson, 1992; Roeser, Midgley, & Urdan, 1996). Other student-level variables such as family background, SES, ethnicity, gender and disability status (Burbridge, 1991; Gronna, Jenkins, & Chin-Chance, 1998; Kiplinger, 1996) have also been found to influence student performance at Grade 8.

Researchers have also concluded that the following school-level conditions account for differences in educational effectiveness: SES of the students within schools, ethnicity of the student body, school location, pupil-teacher ratios, number of experienced teachers, school organizational grade configuration, school size, and administrative leadership (Crone & Tashakkori, 1992; Eccles et al., 1991; Moore, 1984; Phillips, 1997; Rumberger, 1995; Tarter, Sabo, & Hoy, 1995; Weishew & Peng, 1987). However, one important school-level variable—"safety" has not been investigated within a multilevel

study. Having a safe environment has been identified as a condition that directly influences individual student achievement within schools (Creemers, 1994).

From a policy perspective, it is important to know how schools effectively educate their students as communities rely on schools to educate their children. It is difficult to alter the background characteristics of students, but it is possible to alter school conditions to improve the safety of the school environment.

METHOD

This state-wide analysis is based upon 46 of the 50 schools with Grade 8 classes from an entire western state. Due to the unavailability of complete classroom-level data, this study used a two-level model. Although this study did not model all the levels within Creemers' (1994) model, a two-level model is still acceptable as the recent literature review of Hill and Rowe (1996) found the majority of multilevel studies have been two-level models incorporating students' (level-1) nested within schools (level-2).

Instruments and Data

This study used scores from the Stanford Achievement Test, 8th Edition (Stanford 8), published in 1992 by the Psychological Corporation as the basis of measuring both prior Grade 6 academic achievement and Grade 8 achievement. It was recognized, however, that standardized test scores may not represent the complete spectrum of schools' curricula nor students learning (Supovitz & Brennan, 1997). Data for the school and student variables included in this study were obtained from state department of education databases for school years 1993 through 1996. Information pertaining to school area demographics were obtained from the 1990 U.S. Census tract information.

Several steps were taken to refine the student sample for analysis. Student records in the 1993, 1994, 1995, and 1996 databases were disaggregated and subsequently aggregated into a longitudinal Grade 6 through Grade 8 sample. The longitudinal sample (n = 8,306) consisted of students who took the Stanford 8 during the Grade 6 in 1994 and in the grade 8 during 1996. This sample accounted for 68% of all Grade 8 Total Reading (N = 12,219) and Total Mathematics (N = 12,096) scores for all students who

took the Stanford 8 in 1996. The data were further refined to control for school structural organizations. Thus, the final student-level sample was reduced to 7,163 students, or 59% of the entire tested population. An analysis of variance of the sample and total tested population indicated minimal differences between these groups. The sample was determined to be representative of the tested student population.

This study concerned students in 50 schools who had eighth-grades. Four schools were excluded from the study due to school organizational changes during the study. A total of 46 schools were included in the study. After the refining the student-level sample, an average of 59% of the Grade 8 students from each school were included in the study.

The limited sample size of the schools necessitated the use of fewer school-level indicators (Kreft & de Leeuw, 1998). Because of the smaller number of level-2 units, highly correlated variables were combined to make "weighted" observed variables. Principal components analysis was used to create two weighted observed variables at the school level. "Safety" was represented by the number of Class A suspensions per school, number of students with Class A suspensions in a school. number of Class B suspensions per school, and number of students with Class B suspensions in a school. Class A suspensions are "major offenses" due to assault, weapons possession, drug usage, and sexual offenses. Class B suspensions are "lesser offenses" due to disorderly conduct, harassment, and insubordination. "Community SES" represents the percent of families receiving public assistance within the community, percent of families below poverty level, mean and median per capita income of the community. Community SES was entered as a control variable.

Other school-level controls included in the analysis were the percentage of Hawaiian and Filipino students, school size, and rural or urban location, school grade configuration, percentage of students receiving special education students and percentage of students receiving free lunch. Student-level control variables included in the analysis were: SES, ethnicity, gender, prior achievement, eighth grade achievement, gender and disability status. SES was measured by whether a student received free or

reduced lunch at school. Fourteen ethnicity categories were collapsed into three groups (1) Asian, (2) Hawaiian/Filipino, and (3) Other.

Procedures for Analysis

This study used hierarchical linear modeling (HLM) procedures to create a two-level model for analysis. This allows the simultaneous estimation of within-school (i.e., student characteristics) and between-school (i.e., safety, community SES) variables on student outcomes. A series of models were estimated using *HLM for Windows 4.1* (1994). Predictors were entered, one at a time based on theoretical and empirical considerations, and evaluated for significance. If the slope of an individual-level variable did not significantly vary between units, the slopes were "fixed" and not allowed to randomly vary.

RESULTS

Using the variables discussed in the literature, several school and student-level variables were selected to build the model based on Creemers' (1994) theory of school effectiveness. The intraclass correlation for mathematics was calculated to be 13.50% between schools and the intraclass correlation for reading was calculated to be 9.46% between schools (see Tables 1 and 2).

Table 1.

One-way ANOVA Model: Mathematics (Fully Unconditional)

Fixed Effect	Coefficient	*SE*	Chi-Square
Average school mean	-0.062	.056	
Random Effects	Variance Component	*df*	
School Mean	.1346**		
Level-1 Effect	.8619	45	1268.26

**$p < .001$

Table 2.

One-way ANOVA Model: Reading (Fully Unconditional)

Fixed Effect	Coefficient	*SE*	Chi-Square
Average school mean	-.0055	.048	
Random Effects	Variance Component	*df*	
School Mean	.0939**		
Level-1 Effect	.8982	45	830.94

**$p < .001$

Several variables were used in examining the influence of school safety characteristics within a school effectiveness model. Correlation matrices were initially used to examine relationships between variables at each level. The correlations between school variables (with aggregated school outcomes) are shown in Table 3. Similarly, student-level correlations of the variables are displayed in Table 4.

Table 3

Intercorrelations between school-level variables

Variables	Size	Safety	SPED	SES	Asian	HawFilip	Lunch	Location	Read	Math
School Size	1.00									
Safety	.71*	1.00								
SPED	.02	.25	1.00							
Community SES	-.03	.06	.11	1.00						
Asian	-.12	-.10	-.20	-.71*	1.00					
HawFilipino	.16*	.12	.16	.63*	-.73*	1.00				
School Lunch	-.42	-.21	.06	.79*	-.50*	.47*	1.00			
Location	.00	.02	.07	.57*	-.57*	.38*	.44	1.00		
Transition	-.37*	-.33*	-.27	-.02	-.36*	.30*	.59*	-.53*		
Reading**	-.08	.11	-.38*	-.50*	.57*	-.65	-.52*	-.30*	1.00	
Mathematics**	.00	.21	-.22	-.70*	.80*	-.68*	-.64*	-.56*	.78*	1.00

*$p < .05$

**Reading and Mathematics are based on average school means and are included for reference.

Table 4

Intercorrelations between student-level variables

Variables	Gender	Lunch	SPED	Asian	HawFilip	Prior Math	Prior Read	Math	Read
Gender	1.00								
Free Lunch	.20	1.00							
Disability	-.11*	.08*	1.00						
Asian	.00	-.23*	-.07*	1.00					
Hawaiian/Filipino	-.02	.20*	.05*	-.52*	1.00				
Prior Math Scores	.27*	-.28*	-.27	.27*	-.33*	1.00			
Prior Reading Scores	.17*	-.28*	.24*	.27	-.34*	.75*	1.00		
Math Scores	.12*	-.27*	-.24*	.36*	-.31*	.86*	.71*	1.00	
Reading Scores	.17*	-.28*	-.26*	.28	-.34*	.72*	.86*	.76*	1.00

*$p < .05$

Criteria for Selecting Variables

Two multicollinear variables were eliminated from the school-level model. School lunch was dropped due to its high correlation with community SES ($R^2 = .79$). Of the two ethnicity categories that were highly intercorrelated ($R^2 = .73$), Asian was dropped from the model. The Hawaiian/Filipino indicator was believed to be a better proxy of the de facto segregation of ethnic population of "minority" groups in some communities within Hawai`i. The summary statistics for the school- and student-level variables are included in Table 5.

Table 5.

Summary of descriptive characteristics for tested models

Variable	Mean	*SD*	Minimum	Maximum
LEVEL 2-SCHOOL VARIABLES (n = 46)				
Community SES	.09	.82	-2.30	1.39
Location of School (Rural Urban)	.61	.49	0	1.00
% Hawaiian/Filipino	.55	.22	.19	1.00
School Size	829.00	360.00	224.00	1846.00
% Students with Disabilities	.09	.03	.04	.19
School Transition	.35	.48	0	1.00
No School Transition (K-8) .	.30	.47	0	1.00
Safety	.65	1.09	-.58	3.57
Reading	-.01	.32	-.56	.59
Mathematics	-.07	.38	-.74	.85
LEVEL I. STUDENT VARIABLES (N=7163)				
Female	.49	.50	0	1.00
Asian	.22	.41	0	1.00
Hawaiian/Filipino	.49	.50	0	1.00
Socioeconomic Status	.37	.48	0	1.00
Prior Grade 6 achievement- Mathematics	-.02	.98	-2.19	2.39
Prior Grade 6 achievement- Reading	-.09	1.01	-2.69	2.3
Disability Status	.11	.31	0	1.00
Mathematics Achievement Grade 8	.04	.99	-2.14	2.43
Reading Achievement Grade 8	.04	.99	-2.41	2.24

Student-level Predictors

Student background characteristics were included to provide controls on within school achievement differences. The student-level coefficients in Tables 6 and 7 indicate that the best within-school predictor of eighth-grade achievement is a student's prior achievement for math (ß = .83, t = 122, p. < .001) and reading (ß = .80, t = 117, p. < .001). In mathematics and reading, the student-level estimates indicated that variables pertaining to ethnicity, SES, disability status and gender were also statistically significant predictors of achievement.

Table 6.

Student-level, school-level safety model of mathematics achievement

Variables	Safety Model	*SE*
Average Achievement	-.0763	.030
SCHOOL-LEVEL		
Hawaiian/Filipino	-.7750**	.179
Community SES	-.1696*	.056
School location	-.2285*	.08
No Transition	.163	.090
Safety	.1251**	.031
STUDENT-LEVEL		
Prior Achievement	.8271**	.006
Asian	.1279*	.017
Hawaiian/Filipino	-.0598**	.014
SES	-.0485**	.013
Disability	-.0408*	.020
Female	.0297*	.012
Variance Component-School	.0394	
Variance Component-Student	.2320	
School Variance Explained	.7071	
Student Variance Explained	.7309	
Reliability	.927	
df	40	
Chi-Square	1083.01	

*$p < .05$ **$p < .001$

Educational Effectiveness Predictors

The most powerful predictor of achievement was whether the school had a high population of Hawaiian or Filipino students. Even controlling for student-level differences, schools with a higher percentage of Hawaiians and Filipinos had statistically significant lower test scores in mathematics (ß = -.78, t = -4.32, $p. < .001$) and reading (ß = -.85, t = -4.68, $p. < .001$) than schools with a less dense concentration of Hawaiian and Filipino students. The second most influential school characteristic was the Community SES. Controlling for differences in student-level characteristics, schools in communities with lower SES characteristics had lower test scores in mathematics (ß = -.17, t = -3.02, $p. < .005$) and reading (ß = -.11, t = -1.99, $p. < .052$) than schools in more "affluent" communities. The location of a school and structural grade organization also influenced student achievement. However, the effects were not statistically significant for both models.

Table 7.

Student-level and school-level safety model of reading achievement

Variables	Safety Model	*SE*
Average Achievement	-.009	.032
SCHOOL-LEVEL		
Hawaiian/Filipino	-.8509**	.182
Community SES	-.1137*	.056
School location	-.107	.082
No Transition	.3031*	.09
Safety	.1069*	.032
STUDENT-LEVEL		
Prior Achievement	.8004**	.006
Asian	.0533*	.018
Hawaiian/Filipino	-.0830**	.014
SES	-.0860**	.012
Disability	-.0890**	.020
Female	.1542**	.012
Variance Component-School	.0404	
Variance Component-Student	.2475	
School Variance Explained	.5697	
Student Variance Explained	.7245	
Reliability	.966	
df	40	
Chi-Square	919.34	

*$p < .05$ **$p < .001$

Effects of Safety

The results indicate a consistency between the influence of maintenance of school order and quiet atmosphere in both mathematics and reading performance. At the school-level, this "safety" variable consistently accounted for statistically significant variance in student achievement between schools. Safer schools had higher test scores in mathematics (ß = .12, $t = 4.01$, $p. < .001$) and reading (ß = .11, $t = 3.38$, $p. < .002$) than unsafe schools. In other words, every one standard deviation increase in school safety produced a .12 standard deviation change in mathematics achievement. Similarly, for every one standard deviation increase in school safety a .12 standard deviation change in reading achievement occurs.

DISCUSSION AND CONCLUSIONS

The student-level variables are a crucial part of Creemers' (1994) model, as their backgrounds and aptitudes are the strongest predictors of their achievement. Across many studies, student background variables have been found to be powerful predictors of learning. The results of this study also suggest several characteristics influence mathematics and reading achievement. These variables were prior achievement, gender, ethnicity, SES, and disability status. While the student-level findings were of interest, they were not the focus of this study. These findings were not unexpected, as they confirm previous research pertaining to student achievement during the eighth-grade (Brandon & Jordan, 1994; Brandon, Newton, & Hammond, 1987; Bruce & Singh, 1996; Burbridge, 1991; Crone & Tashakkori, 1992; Hernandez-Gantes, 1993, 1995; Kiplinger, 1996; National Center for Educational Statistics, 1997; Roeser et al., 1996). These characteristics need to be included in studies pertaining to the effectiveness of schools because they account for the within school student differences between schools.

The school-level results indicate community SES and cultural variables influence achievement. These findings concur with the previous middle-level school research (Crone & Tashakkori, 1992; Fowler & Walberg, 1991). However, this was not the focus of the study. Rather, they were considered as school-level controls because of the diversity of school environments in Hawaii. They do account for variance in learning between schools, and because of this, remain a challenge to policymakers interested in making comparisons between schools.

The main purpose of this study was to understand the influence of school safety on student achievement at the middle level. This study found a statistically significant amount of the between-school variance in student learning was attributed to differences in level of safety among schools. The results indicate a consistency between the influence of the school-level of maintenance of order and quiet atmosphere in both mathematics and reading performance. Students within "safer schools" performed better than students within unsafe schools. In other words, students in schools with fewer suspensions

based on assault, weapon possession, drug usage, sexual offenses, student insubordination and harassment had higher test scores than students in schools with more suspensions. This empirical finding confirms the notion purported by Prothrow-Stith (1995): in more violent schools, students have less time to focus on academic activities as violence negatively affects a child's learning. This finding also supports the suppositions of Furlong et al. (1995), Harris (1995) and Kimweli and Anderman (1997) who propose safety characteristics of a school might explain variance in student achievement between schools.

A number of cautions should be raised in examining the study's findings. The number and type of variables included in this study were limited by the degree of comprehensiveness of the demographic data accessed in the state databases. These databases did not include complete records of classroom and teacher variables for all students within the database. Therefore, classroom variables were not incorporated into testing Creemers' (1994) theoretical model of school effectiveness. Additionally, some demographic variables pertaining to school community socioeconomic indicators were drawn from the 1990 US Census and may be dated. The students included in this study were limited to those students who attended public schools during fifth, sixth, seventh, and eighth-grade in the period of 1994 to 1996.

Despite these cautions, the results suggest that school safety receive increased attention from policymakers because of its impact on student learning. It is likely that it also interacts with other school level process variables as principals and teachers attempt to make school improvements. From this research, it is obvious that some school contexts are more difficult places in which to learn, and this has a measurable impact on students' achievement. Future research should continue examine how safety affects school processes and improvement efforts.

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