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**THE SPATIAL DYNAMICS OF HIGH SCHOOL DROPOUT:  
THE CASE OF RURAL LOUISIANA**

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ABSTRACT

This study uses data from the Louisiana Department of Education to conduct a spatial analysis of high school dropout. The paper suggests school-level factors influence dropout rates not only within their schools, but also more widely across schools in close proximity. These claims are tested in two distinct ways: (1) by comparing spatial cluster maps of dropout to measures of school processes, effectiveness, and structure and (2) by conducting spatial regression analysis to test whether spatial influences remain after considering school-level predictors of dropout. The findings show school processes, effectiveness, and structure all influence dropout rates. Moreover, findings demonstrate spatial patterns in rural high school dropout in Louisiana, suggesting the mechanisms driving dropout extend beyond the school level. These mechanisms may be related to rural labor market structures. Future research should focus more specifically on the link between shifting rural labor markets and high school outcomes.

Despite the increased importance of a high school education for entry to postsecondary education and the labor market, the national rate of dropouts has shown limited decreases over the last three decades and has been stable throughout the 1990s (Kaufman, Alt, and Chapman 2001).

High school dropout rates vary widely across schools and districts. Scholars of rural education are particularly concerned because the increased importance of the high school requirement has come during a period many rural schools, families, and communities have witnessed severe resource deficits (Rosigno and Crowley 2001). Strong, cohesive rural communities can probably mitigate some harmful effects of economic decline (Israel, Beaulieu, and Hartless 2001). At the same time, maintaining the networks of social relationships that sustain community social capital is increasingly challenging during periods of changing labor market structures and community patterns that disrupt the fabric of rural life, patterns of community organization and cooperation, and support for local schools (Swaim and Texiera 1991, Tickamyer and Duncan 1990).

This paper examines the spatial dynamics of high school dropout in rural school districts in the state of Louisiana. The study extends a trend in the analysis of high school dropout and completion, in which attention has shifted upward from characteristics of individual students and their families to “school effects.” In specifying school effects, sociological studies of dropout have furthered an understanding of the role of the school environment. More specifically, it draws upon the work of Riehl (1999) and Rumberger and Thomas (2000) to examine the

relationship between school processes, school effectiveness, and high school dropout. Empirical studies of school effects provided an important theoretical and methodological corrective to previous research emphasizing individual and family effects. This paper extends the analysis further by including a spatial analysis to differentiate between school and regional influences. Spatially correlated school effects would suggest broader regional factors shape the pattern of high school dropout, while spatially uncorrelated effects would indicate particular characteristics of schools and students drive the dropout phenomena.

There are several reasons to believe school effects may extend beyond the boundaries and borders of any particular school. *First*, public schools are embedded administratively within districts and, accordingly, schools within the same district should exhibit similar policies, procedures, and resources. *Second*, schools draw students from the proximate communities that may correspond directly with school boundaries (school draws all students from same community or neighborhood), but considerable overlap exists. Some schools draw from several socially and economically disparate communities while in other cases students from the same community attend several different schools. *Third*, regional contexts may have a broad influence spanning several schools and districts. In particular, the nature of rural labor markets (how they are structured and how they have changed) may affect a wider area in a homogeneous way but not necessarily broad categories of areas. Therefore, spatial analysis is also an improvement over categorical designations such as rural/suburban/urban, nonmetro/metro, or even nonmetro-isolated/nonmetro-adjacent/metro-noncore/metro-core, and so forth. These categories can be very useful in describing the different social, economic and policy contexts within which schools operate, but they also impose within category uniformity not supported by empirical data.

### Goals and Objectives

To develop a better understanding of the influences of schools, districts, and broader regional characteristics on high school dropout, this research mapped the locations of 131 rural high schools embedded within 36 rural school districts in Louisiana, and compiled data for each school on particular school and student characteristics. The approach enabled systematic examination of spatial relationships at the school level and allowed for the determination of whether spatial clustering affects findings from school-level analysis of high school dropout.

### **How Schools Influence Incidence of Dropout**

Research on high school dropout focused on individual- and family-level factors causing students to leave before completing school until Riehl (1999) and, subsequently, Rumberger and Thomas (2000) outlined different ways in which school-level factors influence the dropout process, including (1) student characteristics, (2) school resources, (3) school structures, and (4) school processes. Student characteristics include both the academic background as well demographic characteristics such as family structure and socioeconomic status, ethnicity, and gender. Importantly, apart from the effects of each individual's characteristics, aggregate student characteristics have been shown to influence educational attainment at the school level (Gamoran 1992).

School resources include indicators such as per-student instructional expenditures and revenues, teachers' salaries, teachers' qualifications, and class size. Several studies suggest a relationship between resources and dropout (McNeal 1997; Rumberger and Thomas 2000; and Rosigno and Crowley 2001), but at least one extensive review of literature on school resources suggests no systematic relationship between school-level expenditures and student performance (Hanushek 1989). Other studies using nationally representative samples (e.g., the National Educational Longitudinal Survey) have found linkages between resources and high school completion (McNeal 1997). Still, the debate over whether resources are the key to school improvement and increased educational attainment is far from resolved.

Structural attributes of schools include size, location, and school type. School size, in particular, has received significant attention. Smaller schools may enable teachers to give students more individualized attention, although they probably cannot offer diverse curricula or retain enough qualified teachers. On the other hand, large rural schools may mean that students have to travel long distances to and from school, and be less likely to engage in extracurricular activities and "fit in" with the school environment.

Location is another structural factor that potentially influences dropout rates. Schools in isolated rural regions may have less access to resources than their counterparts (Rosigno and Crowley 2001). Moreover, some have suggested that labor market characteristics influence academic attainment, especially where students (and parents) perceive diminishing returns to completing high school. Said differently, students may not perceive completing high school as important (and their parents may have lower expectations for them) in communities where few

employment opportunities require a high school diploma. While the proportion of these communities is shrinking, still many occupational communities exist (fishing, shrimping, etc.) as well as communities specializing in low-skill, high wage employment (e.g., in the timber and oil industries), where the perception that the high school credential is essential is not as prevalent as it is in other rural areas. Importantly, this type of structural characteristic of a school cannot adequately be captured in absolute terms using categorical variables—urban/rural, small town/large town, and so forth—but must be defined in relative terms depending on the geographical distribution of schools within and across labor markets.

Perhaps the most significant new line of research in recent years has involved the focus on how school processes influence high school dropout (Dorn 1996, Riehl 1999, Rumberger and Thomas 2000). School processes involve the mechanisms used by schools to establish and maintain discipline as well as to meet performance objectives. Disciplinary considerations have attained a higher level of prominence in the wake of highly publicized school shootings in across the nation. Schools vary in how, why, and when students are expelled, suspended or held back a grade, and some studies suggest these processing differences influence dropout rates. Riehl (1999) interviewed staff in 100 public high schools in New York City and found that some could respond to both the desire to discharge certain types of students and the pressure to reduce dropout rates by actively seeking to place discharged students into GED or alternative education programs (because such students would not count as dropouts). Other organizational case studies similarly suggest schools vary widely in their policies, practices, and procedures for retaining students or discharging them as dropouts (Fine 1991, Bowditch 1993). School processes are also important because they can contribute to student disengagement from schooling (McNeal 1997).

### **The Wider Environment: Connections between Schools**

School-level analyses view each school as a separate analytical entity, each with its particular student composition, structure, resources, and processes. Yet this conceptualization is troubling because it fails to consider systematic similarities and differences among schools near each other. First, because schools are embedded within districts certain school-level policies, resources, and processes vary at both the school *and* the district levels. For example, schools vary in the socioeconomic and racial composition of the student body. However, school financing, staffing, and certain processes and performance objectives are often defined at the district level.

The relationship between schools and districts is hierarchical (e.g., Schools are embedded within districts). Nevertheless, geographical contexts may also influence school-level outcomes, despite whether or not schools in close proximity are contained within the same district. Schools in close proximity most likely enroll children from the similar communities or neighborhoods with similar social and family background characteristics.

One way in which researchers have attempted to examine or control for broad regional differences is by employing categorical variables to distinguish between two or three broad contexts: the rural school environment versus the urban or suburban one. The evidence shows rural disadvantage in educational attainment and achievement. Rosigno and Crowley (2001) show that rural students have fewer family and school resources and, they argue, that this lack of resources explains their poor educational outcomes. However, whether the root cause of academic failure is location or lack of resources, as suggested by Fan and Chen (1999), remains a difficult question to answer. One problem with studies that use dichotomous or ordinal variables to represent locality is that substantial diversity often exists *within* rural areas (Paasch and Swaim 1998). The rural versus urban focus is flawed because it understates the diversity (of schools and communities) found within rural regions.

### **Capitalizing on Advantages of Spatial Analysis**

Spatial analysis offers a way of incorporating the broader geographical context into school-level studies of high school dropout. Spatial techniques offer an improvement over classification systems (e.g., urban/rural, metro/nonmetro) where the assumption is implicit that effects are essentially uniform within categories. The spatial techniques used in this paper advance understanding of regional contexts of high school dropout in the state of Louisiana. Cluster analysis enables a visual inspection of spatial clustering on school-level variables. Spatial regression analysis is used to incorporate consideration of clustering in school-level analysis. Spatial regression is useful for modeling the effects of unobserved variables with systematic locational distributions. The underlying processes that cause spatial clustering may not be readily apparent, but speculation may stimulate further investigation of regional effects on high school dropout. No matter whether speculation of regional effects is convincing, the existence of systematic clustering is a violation of a basic assumption of ordinary least squares (OLS) regression (independent errors) and,

therefore, controls for such relationships should be incorporated into regression analyses.

Scholars conducting spatial analysis must consider the possibility that spatial relationships vary across contexts. Thus, studies of neighborhood dynamics within urban settings are restricted to areas within the city limits (e.g., Morenoff's 2003 study of birth weight in Chicago). Similarly, Hammer et al. (2004) limit their analysis of temporal residential density patterns to the north-central section of the United States, arguing spatial relationships are unique to this specific region. In Louisiana, spatial relationships across schools differ depending upon whether schools are in metropolitan or non-metropolitan areas. Within metropolitan areas, school-level similarities and differences are more likely to reflect neighborhood residential patterns. Outside the metropolitan areas, school-level similarities may reflect broader regional (i.e., labor market) characteristics. This study is concerned solely with spatial dynamics across rural schools. A comparison of metro and nonmetro high school characteristics is included in Appendix A.

### **The Case of Rural Louisiana**

Since earning notoriety for having the lowest high school completion in 1990, Louisiana has tried to reduce dropouts while improving the overall quality of the state education system. By 2002, the state had made considerable progress, with nearly 70% of its high school seniors were graduating each year (the national average) and 59% of Louisiana's high school graduates enter college immediately after high school, 2% more than the national average (National Center for Public Policy and Higher Education 2004). The positive increase in senior graduation and college enrollment were offset, however, by the fact that only 55% of Louisiana's public school students finished high school within four years, compared with a national average of 66% (National Center for Public Policy and Higher Education 2004). Although historically insular, with comparatively low rates of in-migration and out-migration, more Louisianans have been leaving the state since the mid-1990s, with most going to Texas (Perry 2003). In response to this perceived "brain drain," Louisiana initiated a merit-based program for funding higher education in 2002, the Tuition Opportunity Program for Students (TOPS).

Louisiana's accountability system incorporates a measure of dropouts for all schools with grades 7 and higher. For high schools, 5 percent of the overall school performance score (SPS) is determined by the dropout rate. In addition, dropouts are included in the computation of test scores in Louisiana, so school administrators

stand to gain very little by encouraging weaker students to drop out to improve test scores.

Louisiana's high school dropout rates reflect the state's rural social and economic diversity in rural areas.<sup>1</sup> Much of Louisiana is poor, but rural regions vary as to economic and racial inequality, as well as in the structure of rural labor markets and commuting patterns that differentially affect rural well-being (Tootle and Tigges 1993).

Further, Louisiana has been striving, within the education systems budget, to both improve school quality and reduce dropout rates through its accountability system initiated in 1998 and approved (with slight adjustments) by the No Child Left Behind commission in 2002. The Louisiana Department of Education explicitly recognizes the importance of completing high school by incorporating dropout measures into the state school accountability system. Moreover, in this period of increasing globalization and rapidly changing labor market structures, high school completion represents a minimum necessary (although now usually insufficient) prerequisite of achieving stable employment and livelihoods.

### **Data and Methods**

This study uses secondary data compiled by the Louisiana Department of Education, available for public use through their web site. Besides data on high school dropouts, Louisiana collects and reports information on a range of school-level variables theorized to influence dropout rates depicting aspects of student characteristics, school resources, school effectiveness and processes, and school structure. All data are available through the Louisiana Department of Education web site. Appendix B lists the precise reports or data sets from which each variable was extracted. Of the 271 high schools in Louisiana, 131 are in nonmetropolitan statistical areas. These figures do not include "alternative" schools with different mandates and accountability requirements, or schools that either opened or closed during the study period (2001-2003).

### **Variable Definitions and Descriptive Statistics**

This section defines each school-level variable included in the analysis and discusses the basic descriptive statistics listed in Table 1.

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<sup>1</sup>In Louisiana, urban high schools have higher dropout rates than rural dropouts (See Table 3, Appendix A). In the nation as a whole, rural dropout rates are higher than urban areas.



Table 1: DESCRIPTIVE STATISTICS FOR DEPENDENT AND INDEPENDENT VARIABLES

VARIABLES	MEAN	SD	MIN	MAX
Dependent Variable				
Dropout Rate 2002-2003 . . . . .	3.73	2.47	0.00	11.40
Independent Variables				
Student Characteristics				
Percent Black . . . . .	33.65	27.35	0.00	100.00
Percent Free and Reduced Lunch	51.82	17.05	6.98	93.18
Percent Student with Disability	9.57	3.85	0.00	24.06
School Resources				
Pupil-Teacher Ratio . . . . .	12.65	2.22	6.27	22.50
Percent Teachers with MA . . . . .	35.93	9.49	7.10	59.30
Percent Core Classes Taught by Qualified Teachers . . . . .	78.84	12.21	40.70	96.90
School Processes and Effectiveness				
Sum of Test Scores . . . . .	67.53	15.80	17.60	110.40
Expulsion Rate . . . . .	0.28	0.51	0.00	2.60
Attendance Rate . . . . .	93.05	2.15	85.50	99.90
Structure				
Total Enrollment . . . . .	512.80	278.31	67.00	1605.00

*Dependent variable.* The dependent variable is the High School Dropout Rate reported for the 2003 school year. The state of Louisiana uses the average of the previous two-years in reporting dropout rates. The dropout rate reported for 2003 is the schools' average dropout rate for the 2001-2002 and 2002-2003 school years. Louisiana conforms to federal definitions of dropout and has taken several steps to insure consistency and accuracy in reporting dropout. The precise definition of a high school dropout is available through the Student Information Systems User Guide (Louisiana Department of Education 2004, pp. 92-95). For the 131 rural high schools included in this study, the mean dropout rate reported for 2003 was 3.73, with a standard deviation of 2.47, and a range from 0 to 11.40.

*Independent variables.* School-level variables potentially affecting high school dropout can be divided into four categories: (1) student characteristics, (2) school resources, (3) school processes and effectiveness, and (4) school structure.

Student characteristics represent aggregated qualities of individual students at each school. Percent Black is the percentage of African American students. Percent

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Free and Reduced Lunch is a measure of student poverty in rural Louisiana. Percent Students with Disability controls for instances where schools have high levels of disabled students. These descriptive statistics in Table 1 demonstrate the racial and economic diversity within rural Louisiana. While about one-third of the students are African American in the typical rural high school, racial percentages span the entire range from 0 to 100 percent black. Similarly, a little over half the students receive a free or reduced lunch (determined by the yearly household income) in a typical rural school, but again schools vary widely (from 7% to 93%) in how many of their students receive subsidized lunches. Less variation in the percent of students with a disability exists, but the range (0% to 24%) is still wide. Rural schools have a particularly difficult time recruiting and keeping qualified teachers at the high school level. Therefore, three measures of school resources focus on the number and quality of teachers: (1) Pupil-Teacher Ratio, (2) Percent of Teachers with a MA Degree, and (3) Percent of Core Courses taught by Qualified Teachers. Table 2 demonstrates that rural schools vary widely in all three of these resource indicators. Pupil-teacher ratios vary from 6 students per teacher to 23 students per teacher. Overall, these figures do not indicate a drastic shortage of teachers in any of the rural schools. However, the Percent of Teachers with an MA and Percent Core Classes Taught by Qualified Teachers exhibit greater variation and range than pupil-teacher ratio.<sup>2</sup>

The next group of variables provides indications of school processes and effectiveness. Test scores are a standard measure of the effectiveness of schools. The indicator used here, Sum of Test Scores, combined two types of test score averages (norm-referenced and criterion-referenced) for each school. This figure represents 90% of the school performance score for each school, while the remaining 10% includes a measure of dropout and a measure of attendance. The raw measure of attendance, Attendance Rate, is included in this analysis, along with expulsion rate, as measures of school-level processes that maintain discipline and prevent absenteeism. The means, standard deviations, and min-max ranges show

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<sup>2</sup>Additional exploratory analysis incorporated alternative school resource measures such as teachers' salaries and school budgets for books and computers. Teachers' salaries for the 2000-2001 school year in Louisiana averaged \$33,929 for rural schools compared to \$36,131 for urban and suburban schools. Rural schools spent less money per pupil on books \$66 per pupil, compared to \$72 per pupil in urban and suburban schools, in part due to the high cost of transportation in rural districts. Irrespective of which resource figures were used, and whether there were significant urban-rural differences, no resource measures significantly affected dropout rates across rural Louisiana.

considerable variation in school processes and effectiveness in the rural part of the state.

Finally, Total Enrollments is a measure of school size, a structural variable. The mean enrollment for the 131 rural high schools was nearly 513, and enrollments varied substantially from a low of 67 students to a high of 1605 students. Because enrollment figures can be positively skewed, a check for skewness was conducted and the analyses were done twice, once with both logged and unlogged enrollment measures. As no substantive difference was found in the results, the models presented do not correct for skewness in enrollments or any other variable.

Beyond size, location is another structural variable thought to influence school-level outcomes. Our conception of location is relational rather than absolute; a school's specific location is not as important as its location relative to other schools. The next section discusses how spatial modeling contributes to a better understanding of the influence of relational location.

### **Spatial Modeling**

The influence of spatial or locational effects can be estimated by modeling autoregressive processes in the error term, "spatial error" model, or in the dependent variable, the "spatial lag" model. The spatial error model offers a way of correcting for the fact that spatial clustering violates OLS assumptions of independent errors, while spatial lag model corrects for the violation of OLS assumption of independent observations (as well as independent errors). Diagnostic tests can help determine which model most appropriately models spatial clustering (Anselin 1995). Spatial clustering of high school dropout is modeled using the spatial error model:

$$Y = X\beta + \lambda\epsilon + \xi \quad (1)$$

Where X is a matrix of exogenous explanatory variables with an associated vector of regression coefficients  $\beta$ ,  $\lambda$  is the autoregressive coefficient,  $\epsilon$  is a vector of error terms, and  $\xi$  is a random error term (Anselin 1988).<sup>3</sup>

Equation (1) is estimated using maximum likelihood estimation in a new, free, user-friendly spatial statistics program, GEODA 0.95 (Anselin, Syabri, and Kho 2004). The spatial effect,  $\lambda$  in equation (1), represents the effects of "spatial

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<sup>3</sup>The same substantive results were obtained whether spatial error or the spatial lag models were employed.

externalities” of both observed variables and unobserved variables. For high school dropout, the spatial effect refers to both the influence on a focal school of the independent variables representing student and school characteristics of adjacent schools, as well as all unobserved characteristics of adjacent schools. So,  $\lambda$  is a structural characteristic, representing location in relation to other schools in the analysis. The hypotheses are straightforward: (1) if adjacent schools have high average dropout rates the focal school will also have high dropout rates, (2) if adjacent schools have low average dropout rates the focal school will also have low average dropout rates, (3) if average dropout rates of adjacent schools is neither high nor low the focal school will not be influenced by its relative location (or, perhaps more accurately, the influences of surrounding schools with high and low dropout rates will cancel each other out). The latter condition may define schools in broad regions with no significant clustering or schools on the borderline of spatial clusters.

The following sections discuss the two spatial analytical strategies and report findings for spatial cluster analysis of high school dropout and, secondly, for a spatial regression analysis of the implications of spatial clustering points for school-level analysis of high school dropout.

### **Spatial Cluster Analysis**

Spatial clustering of rural high school dropout was explored by using GIS mapping and GEODA software (Anselin, Syabri, and Kho 2004). In GIS, a point is used to represent the precise latitude and longitude of each school. With point data, several methods can be used to create spatial weights representing adjacent schools including (1) the  $k^{\text{th}}$  nearest neighbor approach, in which  $k$  represents the number of schools deemed to influence the focal school; (2) the distance band approach, in which all schools within a prescribed distance,  $k$ , are deemed to influence the focal school, it; or (3) the Thiessen polygon approach, in which the point data representing schools are first converted to Thiessen polygons using an algorithm that minimizes distances between schools and then contiguous spatial weights are created for the polygons representing each school (Anselin 1995). The Thiessen polygons approach was adopted because it best approximated a conceptualization of schools as having representations beyond their borders that extend into the community or “catchment” areas. With the Thiessen polygon approach, schools are treated in the same way as neighborhoods within a city (see Morenoff 2003). Each

neighborhood or school potentially influences outcomes in surrounding, contiguous neighborhoods or schools.

The analysis begins with an examination of maps of high school dropout rate clusters in rural Louisiana (Figure 1). The map depicts a Moran typology in which each school is classified into one of four categories based on whether its dropout rate is above or below the mean dropout rate *and* whether the weighted average dropout rate of adjacent schools is above or below the mean. Thus, the four categories are: (1) “High-high” schools having dropout rates above the mean and a weighted average of the neighboring schools’ dropout rates also above the mean; (2) A “low-high” schools having below average dropout rates, but a weighted average dropout rate of neighboring schools above average; (3) “high-low” schools with above average dropout rates surrounded by schools with weighted averages below the mean dropout rate; and (4) “low-low” schools with low dropout rates by schools with low dropout rates.

In creating spatial weights, all Louisiana high schools were included to incorporate consideration of how all neighboring schools, including those within metropolitan statistical areas, affect rural school dropouts. Including urban schools in creating spatial weights is particularly important since at least one previous study has suggested that proximity to metropolitan areas influences student performance and outcomes (Israel, Beaulieu, and Hartless 2001). Moreover, some non-metropolitan schools may have been affected by the particular history of desegregation in the state of Louisiana, which has at times involved substantial white flight from urban school districts to rural neighbors (Bankston and Caldas 2002). At the same time, metropolitan schools are only included in the creation of spatial weights as the focus remains on regional relationships across rural Louisiana. In creating Moran maps, only rural school means are used to distinguish between the high and low categories.

### **Spatial Cluster Analysis Findings**

Figure 1 displays the Moran typology cluster map of high school dropout rates for 2003 in rural Louisiana.<sup>4</sup>The map shows a relatively large cluster of light gray polygons signifying low high school dropout in the southwestern part of the state, north of the Lake Charles metropolitan area. Smaller clusters of dark gray shaded

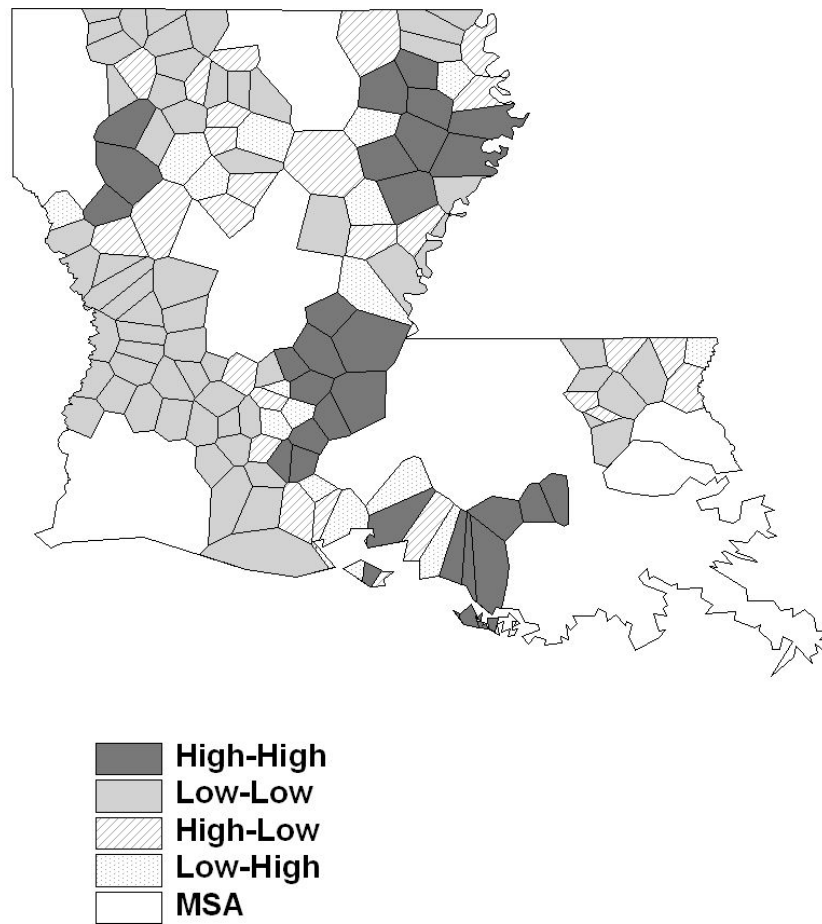
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<sup>4</sup>The dropout figures represent an average dropout rate for the previous two years. In this case, 2001-2002 and 2002-2003 school years.

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Figure 1. LOCAL MORAN FOR DROPOUT RATE



school polygons can be seen in areas next to the Baton Rouge, New Orleans, and Houma metropolitan statistical areas, as well as in the delta region in northeast Louisiana. In northwest Louisiana, however, schools representing all four

categories of high school dropout indicate very little clustering in the region. Besides the Moran Typology cluster map shown in Figure 1, the Moran I significance map was used to determine the degree to which the observed clusters represent statistically significant relationships between the dropout rates of focal schools and the weighted average dropout rates of their contiguous neighbors. This map (not shown) confirms that some clusters observed in Figure 1 depict significant clustering although other spatial relationships, particularly in the northern part of the state, fail to achieve statistical significance at the  $P < .05$  level.

Figures 2-5 present the Moran typology cluster maps for school effectiveness (test scores), processes (expulsion and attendance rates), and enrollment. Figure 2 indicates less clustering in test scores than in dropout, although considerable clustering of high schools still occurs with respect to test score averages. More effective schools should exhibit lower dropout rates and, indeed, considerable overlap between school effectiveness and dropout exists. In total, 51.1% of the schools in the high-high dropout category are in the low-low test score category, while 62.3% of schools in the low-low dropout category are in the high-high test score category.

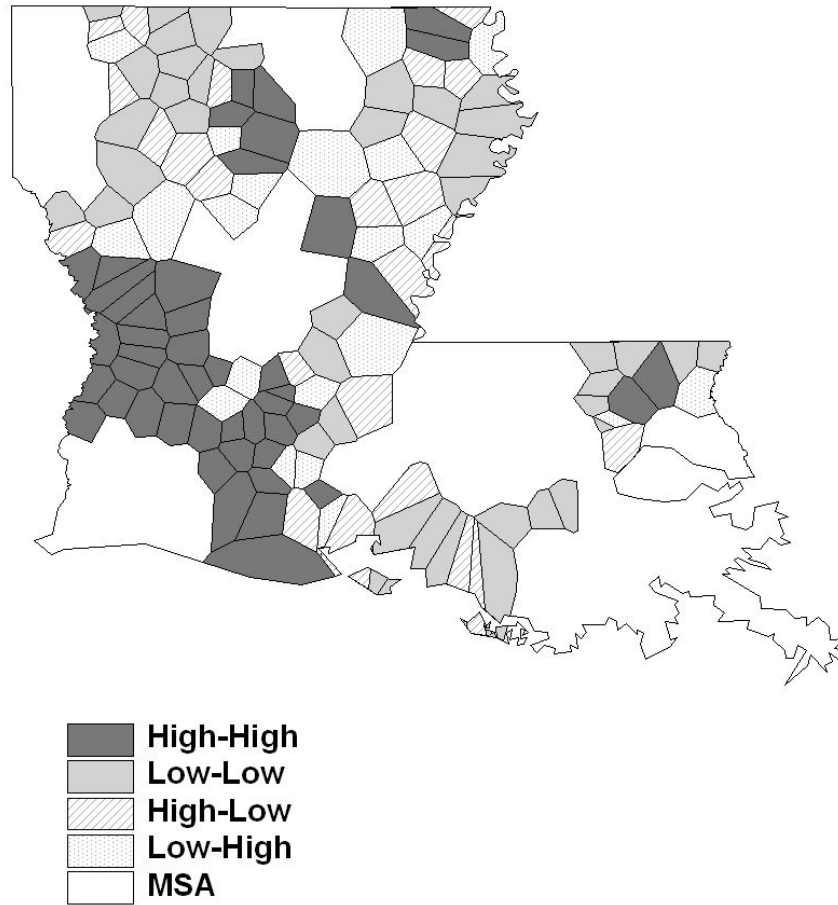
Figures 3 and 4 depict clustering of schools with respect to expulsion and attendance rates, respectively. Again, if school processes matter, schools with lower expulsion rates and higher attendance rates will exhibit lower dropout rates. And again, considerable overlap exists: Of those schools in the low-low dropout category (e.g., the school has lower than average dropouts *and* is surrounded by schools with lower than average dropouts), 69% are also in the low-low expulsion category, while 74% are in the high-high attendance category. The significance maps for both expulsion and attendance confirm the statistical significance of spatial clustering on both these variables, although the strength of the spatial relationships is not as strong for these two measures of school processes as for dropouts (e.g., the significance maps show more schools' dropout rates are significantly related to the dropout rates of their surrounding schools than are their expulsion or attendance rates).

Figure 5 depicts the spatial clustering of enrollment. The map shows enrollments are lowest in the Delta region of the northeast, and some smaller clusters of small (low enrollment) schools occur in the west and northwest. The significance map confirms clustering of schools by enrollment. Of schools in the

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Figure 2. LOCAL MORAN FOR SUM OF TEST SCORES

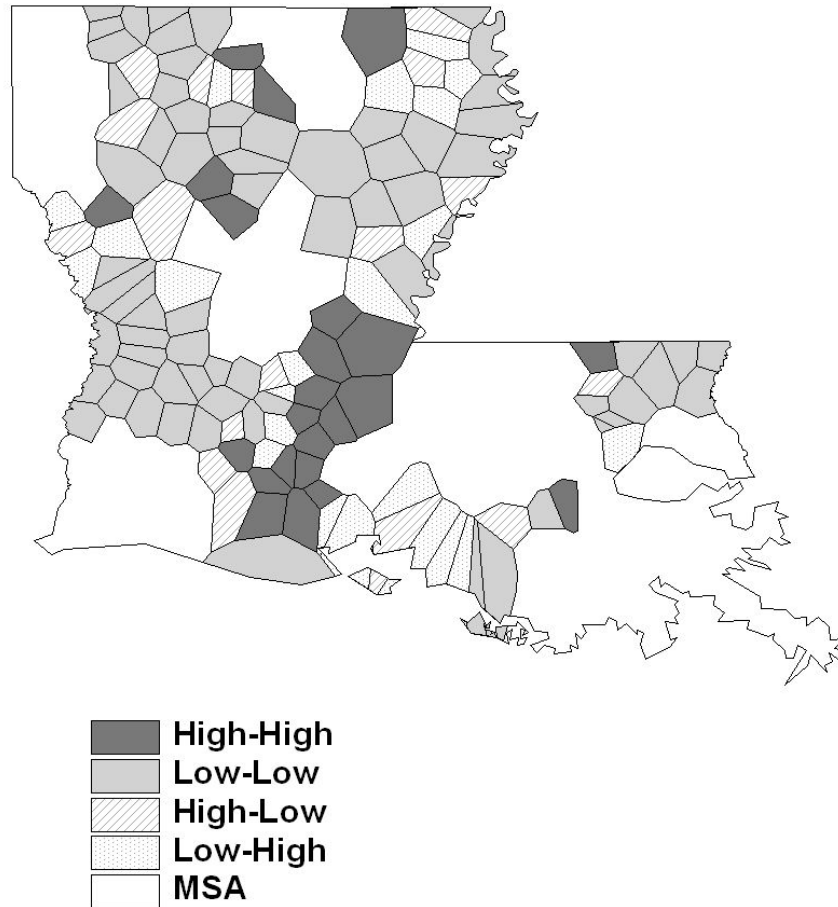


low-low dropout category, 70% are also in the low-low category with respect to enrollment, confirming that dropout rates tend to be lower in smaller schools.

The maps depicted in Figures 1 through 5 provide a visual examination of clustering of dropout rates and predictors, and they suggest that the apparent



Figure 3. LOCAL MORAN FOR EXPULSION RATE

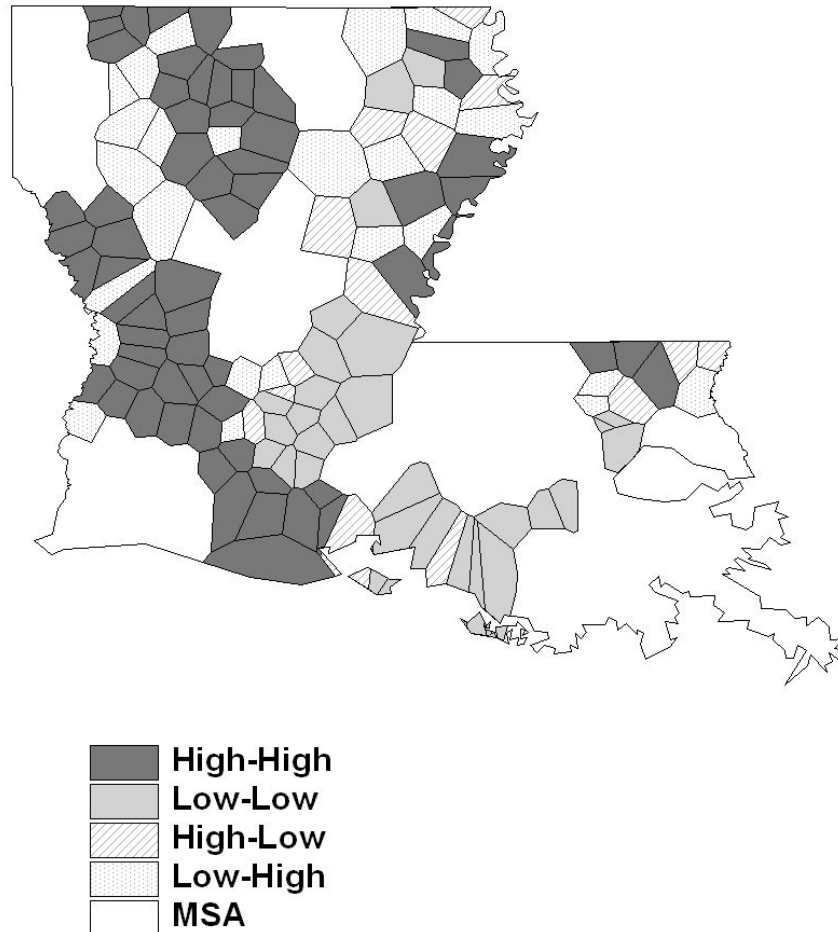


clustering of high school dropout may be an artifact of clustering of other school characteristics. In other words, if enrollment, test scores, expulsion rates, and attendance rates are good predictors of dropout, no spatial autocorrelation should exist after controlling for these variables in a regression model. Alternatively,

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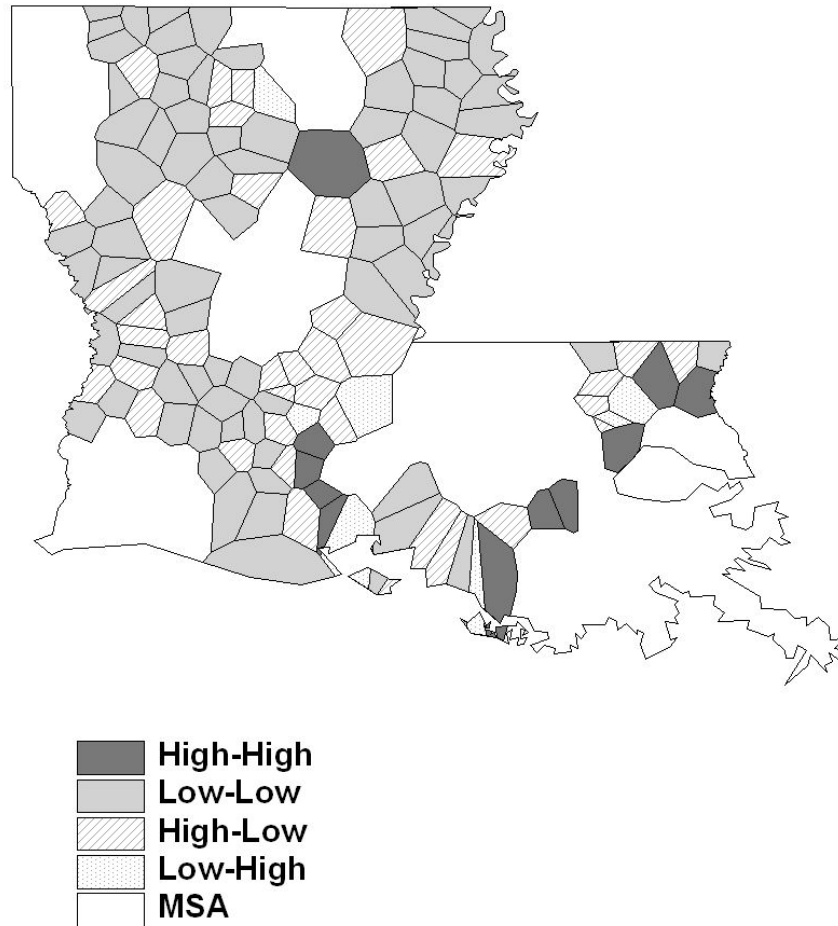
71

Figure 4. LOCAL MORAN FOR ATTENDANCE RATE



spatial autocorrelation may remain even after controlling for school-level predictors of dropout. If this is the case, the clustering of high school dropout observed in Figure 1 is driven by true spatial processes that extend beyond the individual school. Then, two adjacent schools may exhibit similar levels of dropout because

Figure 5. LOCAL MORAN FOR TOTAL ENROLLMENT



the characteristics of one school (both observed and unobserved) influence the dropout rate in the other school, and visa-versa, despite either school's particular characteristics. This is the essence of spatial regression analysis, to determine the extent to which "neighboring" schools influence outcomes in focal schools.

### Spatial Regression Analysis

The two competing explanations of spatial clustering in high school dropout are tested in Table 2. The table presents four regression models: (1) OLS regression of high school dropout on student characteristics and school resources only; (2) OLS regression of high school dropout on student characteristics, school resources, school processes and effectiveness, and school structure; (3) spatial error maximum likelihood regression of high school dropout on student characteristics, school resources, school processes and effectiveness, and school structure; and (4) spatial error maximum likelihood regression of high school dropout on the significant variables from Model 3, only.

The autoregressive coefficient,  $\lambda$ , for the spatial error term,  $\epsilon$ , represents the change in a focal school's dropout rate associated with a one-unit change in unobserved characteristics of adjacent schools. The  $\lambda$  coefficient also conveys information about the strength of spatial externalities. In substantive terms,  $\lambda$  represents the rate at which spatial externalities (unobserved characteristics of adjacent schools) contribute to dropout rate in the focal school.

### Spatial Regression Findings

Model 1 presents the coefficients and standard errors for OLS regression containing only those independent variables representing student characteristics and school resources. The results show schools with higher percentage of black students have higher dropout rates, controlling for other factors in the model. Thus, little evidence is found that school resources influence dropout rates in rural Louisiana.

Model 2 presents OLS regression results for the full model including school effectiveness, process, and structural variables. Higher test scores and attendance rates reduce dropout rates while higher expulsion rates and enrollments increase dropouts, net other factors. These results seem to suggest a strong relationship between school processes, effectiveness, and structure (enrollment) and high school dropout in Louisiana. On the other hand, student characteristic and school resource variables appear to have little influence on dropout rates.

Model 3 presents the spatial error regression model that replicates Model 2 but includes a spatial error term ( $\lambda$ ). Although the effects of school process, effectiveness, and structure variables are weaker, the effects of test scores, enrollment, attendance, and expulsion on dropout remain significant (or nearly so) even after controlling for spatial autocorrelation. Moreover, the spatial error term

Table 2: OLS AND SPATIAL ERROR REGRESSION COEFFICIENTS FOR HIGH SCHOOL DROPOUT RATES IN RURAL LOUISIANA (N=131)

VARIABLES	MODEL 1 (OLS)		MODEL 2 (OLS)		MODEL 3 (SPATIAL ERROR)		MODEL 4 (SPATIAL ERROR)	
	B	SE	B	SE	B	SE	B	SE
Student Characteristics								
Percent Black . . . . .	0.042	0.010***	0.013	0.012	0.012	0.011		
Percent Free and Reduced Lunch . . . . .	-0.003	0.017	-0.018	0.015	-0.017	0.014		
Percent Student with Disability . . . . .	-0.091	0.056	-0.077	0.047	-0.051	0.046		
School Resources								
Pupil-Teacher Ratio . . . . .	0.129	0.094	-0.089	0.090	-0.049	0.086		
Percent Teachers with MA . . . . .	-0.012	0.023	-0.015	0.019	-0.006	0.018		
Percent Core Classes with Qualified Teachers	0.001	0.018	0.001	0.015	-0.005	0.014		
School Processes and Effectiveness								
Sum of Test Scores . . . . .			-0.055	0.019**	-0.058	0.018*	-0.065	0.011***
Expulsion Rate . . . . .			0.886	0.357*	0.616	0.334 <sup>†</sup>	0.523	0.334
Attendance Rate . . . . .			-0.333	0.090***	-0.226	0.089*	-0.216	0.089*
Structure								
Total Enrollment . . . . .			0.015	0.001*	0.001	0.001*	0.001	0.001*
Spatial Error Term ( $\lambda$ ) . . . . .					0.329	0.108*	0.366	0.105***
Intercept . . . . .	2.079		40.151		29.893		27.216	
R-squared . . . . .		0.194		0.442		0.477		0.463

\*p<.05, \*\*p<.01, \*\*\*p<.001

<sup>†</sup>p<.05 for one tail tests

is both positive and significant indicating that the effects of spatial clustering extend beyond the observed variables included in the analysis. Model 4 includes only significant variables from Model 3 in a spatial error regression as a check against the possibility that the results of Table 3 were not robust against different specifications of the model. Except expulsion rate, all other significant independent variables in Model 3 retained their statistical significance in Model 4.

In Models 3 and 4,  $\lambda = .33$  and  $.37$  respectively, meaning the total effect of observed and unobserved school-level causes of dropout are about one-third larger when the effects of externalities from surrounding schools are taken into consideration.

The findings from Table 2 have two important implications for theories of high school dropout. *First*, the results demonstrate clear support for the argument that school processes do have an influence. Schools that perform better, attract higher attendance, and deal with disciplinary matters without resorting as often to expulsion have more success preventing dropout. *Second*, the results confirm that school effects extend beyond the narrow confines of individual schools. The significant spatial error term means that schools in close proximity tend to exhibit similar dropout rates even after controlling for other school-level predictors. When conceived of in relational terms, the structural attribute of school location means that some systematic regional factors influence dropout rates similarly among schools in close proximity.

### Discussion and Conclusion

The results of this study clearly demonstrate support for the contentions of Riehl (1999), Rumberger and Thomas (2000) and others who argue that school processes influence dropout rates. Increasing test scores and attendance rates seem to represent one ideal approach to reducing dropout rate. On the other hand, schools with high levels of expulsion also tend to have higher dropout rates. These significant findings hold even after controlling for aggregate student characteristics and school resources. Moreover, the influence of school effectiveness and processes holds even after accounting for spatial clustering in high school dropout. The importance of establishing appropriate school processes cannot be understated, and school processes must be understood *in relation to* resources and student characteristics as opposed to a conceptualization that puts these considerations strictly into distinct categories. Certain Louisiana's high schools vary widely with respect to the resources they command or the characteristics of the students they

teach, but within these contexts schools also vary in policies, procedures, and practices used to insure discipline and academic achievement.

Without minimizing the importance of school processes, the essential finding of this study was that high school dropout rates exhibit spatial clustering, and that clustering has a significant influence on dropout in any particular school. Spatial analysis requires us to consider whether the influence variables assigned to ecological units of analysis is exhibited primarily within the geographical unit or more broadly. By treating schools as neighborhoods, this study demonstrated the broader influence of observed and unobserved school-level characteristics have on the dropout rates in adjacent schools. The significance of the spatial error term means simply that rural high school dropout rates are more similar to schools near them than would be the case if a random spatial distribution of schools existed in the state. Moreover, this clustering influences dropout rates even after controlling for all other school-level predictors. In short, location matters, but in spatial analysis location must be conceptualized in relative rather than absolute terms.

Spatial clustering of dropouts may reflect differential opportunity structures of the different rural labor markets and commuting zones within Louisiana. Within each labor market area, norms and cultural representations may differ with respect to whether or not a high school credential is perceived as a necessity for your young adults to preserve opportunity and maintain productive livelihoods. Additional research should examine the relationship between labor markets and school outcomes more closely. However, even if labor market structures are not the driving force, the empirical fact of significant spatial clustering of high school dropouts requires the use of spatial statistical techniques.

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### Appendix A

This study includes only the 131 schools located in nonmetro Louisiana parishes. These nonmetro (or rural) high schools significantly lower dropout rates, lower percentage of black students, higher attendance rates, and lower pupil-teacher ratios than their urban and suburban counterparts, N=140. There was no statistical difference between metro and nonmetro schools average test scores.

Table 3: COMPARISON OF METRO AND NONMETRO SCHOOLS

	METRO (N=140)	NONMETRO (N=131)
The Average Test Scores	66.53	67.53
Dropout Rate*	4.89	3.73
Percentage of Black Students*	41.53	33.65
Attendance Rate*	92.13	93.05
Pupil-Teacher Ratio*	13.46	12.65

\* t-test shows significant metro/nonmetro differences at  $p < .05$  level

## SPATIAL DYNAMICS OF HIGH SCHOOL DROPOUT

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The comparisons reflected in Table 3 give a basic comparison of metro versus nonmetro differences in high school dropout, staffing, processes, and performance. Again, the focus of this paper is limited to comparisons among nonmetro schools.

**Appendix B**

All data available at Louisiana Department of Education web site:

<http://www.doe.state.la.us/lde/index.html>

Source Database or Document	Variables
Attendance and Dropout Rates, Indexes, and Points for 2002-2003 Accountability (Excel Spreadsheet ATTDROP0203.xls)	Dropout Rate Attendance Rate
Fall 2002 School Accountability Results, 2002 School-level Subgroup Data (excel file)	Percent Black Percent Free and Reduced Lunch Percent Students with Disability Total Enrollment
2002 District Composite Report, Section 2: School Characteristics and Accountability Information (.pdf file)	Pupil-Teacher Ratio (October 1 Faculty divided by October 1 Membership) Percent of Teachers with MA degree Percent Core Classes Taught by Qualified Teachers
2002 District Composite Report, Section 3: Student Participation (.pdf file)	Expulsion Rate
2001 Detailed School-Level Accountability Data (excel file)	Test Scores