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Academic Achievement of Rural School Students: A Multi-Year Comparison with Their Peers in Suburban and Urban Schools

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This study examined achievement differences among rural, suburban, and urban school students, using data from the National Education Longitudinal Study of 1988 (NELS:88). Performance comparisons were made for nationally representative samples of 8th, 10th, and 12th graders in reading, math, science, and social studies. We found that rural students performed as well as, if not better than, their peers in metropolitan schools. These results provide evidence that, all else equal, rural students do not suffer disadvantage simply as the result of their residence in rural areas or their attendance at rural schools.

For quite some time, a general perception of the comparative inferiority of rural schools has prevailed. This view implies the existence of rural-urban differences in students' academic performance. The general perception of rural-urban differences extends as well to many other socially desirable outcomes, such as aptitude, intelligence, and aspiration (DeYoung & Lawrence, 1995; Herzog & Pittman, 1995). This issue of whether real differences in educational outcomes exist between rural school students and their peers in suburban and urban schools has been a topic of debate among researchers, with particular salience for practitioners in rural areas.

The concern about potential rural-urban differences in education outcomes is not limited to this country, but rather appears to be a global issue. For example, research comparing students from rural and "metropolitan" (urban and suburban) areas on a variety of social, psychological, and educational outcome variables have been conducted in South Africa (Liddell, 1994; Mwamwenda, 1992), Nigeria (Akande, 1990), Australia (Northern Territory Department of Education, Darwin, Australia, 1992), India (Singh & Varma, 1995), and Peru (Stevenson, Chen, & Booth, 1990). Because rural-urban differences in cultural, economic, and political conditions can differ drastically from one country to another, findings from a study conducted in one country are not necessarily generalizable to another. For this reason, we limit our review of the literature and discussion to studies conducted in the United States only.

The major reasons for the conjecture that students in rural areas receive an inferior education compared to their metropolitan counterparts can probably be described as a "deficit model" of rural community and lifestyle. Although it may be difficult to pinpoint the origin and all the important elements of this model, Herzog and Pittman (1995) have provided insightful discussion about the major components that characterize the deficit model. In addition to the problem of societal bias and prejudice against ruralness, Herzog and Pittman paint a somewhat bleak picture of major societal trends that have not been kind to rural communities and schools. Herzog and Pittman describe demographic and economic trends as potentially damaging to rural schools. Outmigration of young people and economic decline would clearly not be expected to improve the quality of rural schooling.

Not surprisingly, like many other issues in education, the research comparing rural students with their suburban and urban counterparts in educational outcomes in general, and in academic achievement in particular, has yielded inconsistent findings (Khattri, Riley, & Kane, 1997). While some studies fail to find any statistically significant differences (Alspaugh, 1992; Snyder & West, 1992; Edington & Koehler, 1987; Haller, Monk, & Tien, 1993), other studies find that students in metropolitan areas exhibit better performance than their rural counterparts in mathematics, reading, and science and on the ACT (Coe, Howley, & Hughes, 1989a,b; Edington & Koehler, 1987; Greenberg & Teixeira, 1995; Lindberg, Nelson, & Nelson, 1985). In other studies, however, students from rural schools were found to have performed better than those from metropolitan areas (Alspaugh, 1992; Alspaugh & Harting, 1995; Haller et al., 1993).

Differences between rural and urban school completion rates (high school and college) seem more certain. As

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Herzog and Pittman (1995) point out, although both rural and urban populations attend school longer than previously, urban students' completion rates between 1960 and 1990 exceed rural students' high school completion rates by about 7%. In addition, the gap in college completion rates between rural and urban students has grown wider with each decade during this 30-year period.

Research Related to Different Academic Subjects

Researchers have compared rural students with students from metropolitan schools on several major areas of academic achievement, including reading, mathematics, science, and social studies. For reading, rural students have been shown to have performance comparable to their urban counterparts (Ratekin, 1971), especially for younger students (Liu & Brinlee, 1983). For math, some studies have found no differences in math achievement scores (Alspaugh, 1992) or the higher-order thinking skills presumably required for mathematics achievement (Haller et al., 1993). Others, however, have found differences in math achievement among schools of different size (Wilson, 1985). Lindberg and colleagues (1985) found that students from small rural schools performed worse than those attending larger schools, and some researchers have concluded that such differences may not be attributable to differences in technology resources (Templeton & Paden, 1991).

There is relatively little research on science achievement, particularly at and below the middle school level. Science is usually considered most properly to be a "hands-on" enterprise that requires specialized equipment and supplies—resources that some rural schools lack, at least in comparison to many suburban schools (Coe et al., 1989a,b; Edington, 1979; DeYoung & Lawrence, 1995). Moreover, Carlsen and Monk (1992) report that, compared to their more urban counterparts, proportionately fewer rural science teachers are experienced, have a science-based education, or have earned a graduate degree. On the basis of these various reports, one might well hypothesize that rural students would be at a disadvantage compared to their suburban and urban counterparts. Haller et al. (1993), however, found that neither ruralness nor school size had any effect on mathematics and science achievement, or on the higher-order cognitive skills presumably required for these subject domains.

Like science, there have been relatively few studies addressing social studies achievement. Easton and Ellerbruch (1985) examined data on over 900 13-year olds and observed that students from the extreme rural communities performed slightly lower than the national levels, whereas those from the "disadvantaged-urban" communities scored much further below the national levels. Families of students in these latter communities exhibited higher rates of unemployment and higher rates of public assistance. Students in the "advantaged-urban" communities, whose parents mostly held professional or managerial positions, scored significantly above national averages.

Major Relevant Factors for the Potential Rural-Urban Differences

A few factors have been widely considered as potential contributors to the hypothesized or reported rural-suburban-urban differences in students' education outcomes: availability of resources, rural-suburban-urban differences in socioeconomic status, and parental and community involvement.

Availability of resources. Differences between rural and urban schools in terms of the availability of resources (e.g., books, computers, art and science supplies, course offerings, and adequately heated or cooled buildings) have been considered by many researchers as one potential contributor to the perceived or some observed rural-urban differences in education outcomes (e.g., Caplan, 1995; DeYoung & Lawrence, 1995; Edington, 1979; Haller et al., 1993; Herzog & Pittman, 1995; Howley, 1996; Jones & Southern, 1992; Marion, 1979; McLean & Ross, 1994; Owens & Waxman, 1995, 1996; Thompson, 1990). The availability of fewer resources in many rural schools than those in metropolitan areas (Coe et al., 1989a,b) are often related to more limited curricula for these rural schools (DeYoung & Lawrence, 1995; Hall & Barker, 1995; Haller et al., 1993). Some research has indicated that the availability of resources makes a difference in students' educational outcomes (Williams, 1996). For example, Kleinfeld, McDiarmid, and Hagstrom (1985) showed that comparable school achievement was accomplished in Alaska after oil money made almost all schools technologically modern, regardless of school locality. Such findings lend credence to the argument that location per se may be less important than availability of learning resources (Liu & Brinlee, 1983).

Socioeconomic status (SES). There is some indication that SES is influential in any rural-urban difference on educational outcomes. SES has been shown to be positively related to students' school achievement (e.g., Coladarci & Cobb, 1996; Kimble, Cramer, & House, 1976; McIntire & Marion, 1989), and it is perceived that there is a difference between rural students and their metropolitan counterparts in this aspect, with rural students usually having lower SES. However, the role SES plays in students' academic achievement may be less important in rural schools than in urban schools. Alspaugh (1992) observed that a large proportion of the between-school variance in school achievement among urban schools is associated with the students' SES, while a smaller proportion of the between-school variance in school achievement among rural schools was associated with the students' SES. In other words, rural and urban students appear to differ in terms of the impact SES has on their school achievement. Howley (1996) seems, by inference, to attribute this differential impact of SES to the smaller size of rural schools and districts, such that only impoverished students benefit from small size.

Another possible influence on hypothesized gaps in educational achievement between rural and urban populations is a long history of emigration by more educated people to metropolitan areas in search of better job opportunities (DeYoung & Lawrence, 1995; Herzog & Pittman, 1995). Population loss contributes to the educational trend of school consolidation, although recent findings suggest that larger schools do not necessarily improve student performance (Haller et al., 1993; Plecki, 1991). Herzog and Pittman (1995, p. 116) point out that school consolidation, partially supported by the conventional wisdom that bigger must mean better (cf. Theobald & Nachtigal, 1995), "has been the single most frequently implemented educational trend in the 20th century." The net effect of school consolidation is not only the creation of larger districts and schools, but conversely, increasingly smaller and poorer rural schools. Even more so than those students who are forced to commute to attend a metropolitan school (Sher, 1995), these smaller, poorer rural schools and their students may be the real casualties of this trend, as fewer students per school usually means less state funding allocated towards those schools, which, in turn, means fewer teachers, a sparser variety of course offerings, and less state-of-the-art equipment and supplies (Herzog & Pittman, 1995; Howley, 1996).

Parental and community involvement. Community and parental involvement have generally been considered as being positively related to student school achievement and subsequent career choices (Alspaugh & Harting, 1995; Ramos & Sanchez, 1995; Rutherford & Billig, 1995). As viewed by some researchers, rural students may be at some disadvantage compared with their metropolitan counterparts in these aspects, because small, isolated, and low-SES rural communities often have less community involvement in education (e.g., DeYoung & Lawrence, 1995). But this view is not generally shared by all researchers. Many researchers believe that smaller schools have a strong community relationship (Alspaugh & Harting, 1995; Herzog & Pittman, 1995; O'Connell & Hagans, 1985), which translates into comparable, if not stronger, community support for school education than communities in metropolitan areas (Caplan, 1995; Jones & Southern, 1992; Lloyd, Lloyd, Prain, & Smith, 1994; Stringfield & Teddlie, 1991). Despite a host of societal trends unfavorable for rural schools, parental and community involvement hypothetically remains a strength of rural schools (Herzog & Pittman, 1995). Herzog and Pittman (p. 118) argued that "rural communities, which for so long have been marginalized by the dominant culture, have precisely the qualities for which the critics of American schools are now looking." For example, rural students have been shown to have stronger feelings of belonging (Herzog & Pittman, 1995) and greater self-concept and self-responsibility, especially in academics (e.g., Morrow, 1989), all of which are positive influences on academic achievement (Gaspard & Burnett, 1991).

Keith, Keith, Quirk, Cohen-Rosenthal, and Franzese (1996), using *National Education Longitudinal Study of 1988* (NELS:88) data, found that the effect of parental involvement (operationalized as parental aspiration for students' education, communication with students) on academic achievement was similar for rural and urban/suburban students. But the study did not directly address the question of whether rural schools enjoyed differential amount of parental involvement. Some researchers believe that parents in small rural communities maintain lower expectations for achievement or are less informed about their children's educational accomplishments so that subsequently the students exhibit lower education and career aspirations (DeYoung & Lawrence, 1995; Furlong & Cartmel, 1995; Motsinger, 1990; Patterson, 1994; Prater, Bermudez, & Owens, 1997; Tompkins & Deloney, 1994; Trice, 1991; Zimbelman, 1987). On the other hand, their metropolitan counterparts may adopt a "sky's the limit" perspective (e.g., Pollard & O'Hare, 1990). Other researchers, however, have found that rural and urban students actually possess comparable career aspirations (Jyung & Miller, 1990; McCraken & Barcinas, 1991) and achievement motivation (Willoughby, Arnold, & Calkins, 1981), though rural students seem to adopt lower income expectations (McCracken & Barcinas, 1991).

Some Common Weaknesses in Previous Research

A close look at the research literature on rural student achievement reveals five likely sources of the inconsistent findings related to possible differences in the academic achievement of metropolitan students.

Issues related to sampling. One problem that plagues many previous studies is reliance on local or convenience samples (e.g., Edington, 1981; Gaspard & Burnett, 1991; Tack, 1995). Generalizing such results beyond the sample (e.g., to all of the rural U.S.) is unwarranted. Abundant inconsistencies based on doubtful validity render a meaningful interpretation of the findings of such studies very difficult at best.

Inconsistent or unclear definitions. In many studies, the terms "rural", "suburban", and "urban" have not been clearly defined, or they have been inconsistently defined across different studies (Herzog & Pittman, 1995). Widely varying criteria have been used to define "rural," even school size (e.g., Haller et al., 1992; Kearney, 1994; Melnick, Shibles, & Gable, 1987) or the size of an area served by a school (e.g., Liu & Brinlee, 1983). Indeed, the literature is marked by the tendency to confound small size and ruralness.

SES as a confounding variable. It is widely documented that SES is positively correlated with students' academic achievement (Coladarci & Cobb, 1996). Although some researchers consider SES as a potential confounding variable in their investigation of rural-suburban-urban differences in school achievement (e.g., Alspaugh, 1992; Corley, Goodjoin, & York, 1991), many others have not attempted to control for this variable in their studies (e.g., Hall, Kelly, & Van Buren, 1995; Ratekin, 1971). It also appears that some studies that do control for SES fail to differentiate between the SES of the student and the SES of the school, a distinction that maybe especially relevant when rural students are bused long distances to attend larger schools that serve a predominantly higher SES community (Maddaus & Marion, 1995).

Ethnicity as a potential confounding variable. Previous studies in this area have rarely considered ethnicity of students as a variable while investigating the academic achievement of rural and urban students (e.g., Hall, et al., 1995; McCracken & Barcinas, 1991). Ethnicity of students, however, can be a potential confounding variable in this area of research for two reasons: (a) considerable achievement differences persist among ethnic groups of students in the U.S. (Fan, Willson, & Kapes, 1996; Reynolds & Brown, 1984); and (b) ethnicity varies markedly across rural, suburban, and urban locales. For example, among African-American students in the NELS:88 database, approximately 22%, 28%, and 50% were in rural, suburban, and urban areas respectively, while the corresponding percentages were about 35%, 47%, and 18% for Caucasian students. If ignored, such unequal ethnic group population distributions, coupled with persistent ethnic group differences in academic achievement and SES, could confound findings.

Sector as a potential confounding variable. Like ethnicity, the distinction between public and private schools has rarely attracted the attention of researchers in this area. Often the omission of private school is intentional, but many reports fail to specify the exclusion of private schools (e.g., Lucas, 1996; McIntire & Marion, 1989). If, however, a study uses both public and private school samples, the failure to undertake appropriate analyses can confound findings for two reasons. First, differences in academic achievement between the private and public school students have been widely documented, although researchers disagree about reasons for the observed differences. Second, the distribution of public and private schools varies across rural, suburban, and urban locales. For example, in the NELS:88 database the percentage of 1988 eighth graders in public versus private schools in the rural areas was 97% vs. 3%, while the corresponding percentage in urban areas was approximately 77% vs. 23%.

The Present Study

The present study used data from NELS:88 to compare the academic achievement of the rural, suburban, and urban school students in four major areas of school learning: (a) reading, (b) mathematics, (c) science, and (d) social studies. All analyses controlled for the effect of SES. More specifically, the major objective was achieved through a series of analyses:

1. for the four major ethnic groups (Asian/Pacific Islanders, Hispanic, Caucasian, and African-American);
2. for public and private school students;
3. for NELS students as they progress from grade 8 to grade 10 to grade 12; and
4. for the four major geographical regions of the United States: Northeast, Midwest, South, and West.

The present study was designed to overcome the five common shortcomings previously identified. First, the issue of nonrepresentative sampling, which plagued many previous studies in this area, was addressed through the use of the NELS:88 database. Second, NELS:88 uses a consistent definition of school locale, based on the definition of Metropolitan Statistical Area (MSA) adopted in the Federal Information Processing Standards and used by the U.S. Census Bureau. The locality classification of a school reflected the school's metropolitan status at the time of 1980 decennial census (NCES, 1994). The disadvantage of this definition is that it is somewhat crude, possibly obscuring regional differences to which a finer-grained typology might be more sensitive. In our opinion, this is probably a necessary evil given the advantages inherent in using a large scale database like NELS:88. Third, SES received full attention in this study, and its possible effect was statistically controlled in the analyses. In NELS:88, SES is a composite score based on five variables: father's education level, mother's education level, father's occupation, mother's occupation, and family income. Fourth, NELS:88 permitted us to make comparisons separately for students of the major ethnic groups. Finally, we conducted separate analyses for students from public and private schools in rural, suburban, and urban locales.

Among these five design improvements, the first strengthens the external validity, while the other four contribute to improved internal validity. Two other features further strengthen the study: (a) multi-year comparisons for students at the 8^{th}, 10^{th}, and 12^{th} grade, and (b) comparisons for major geographical regions of the United States. The multi-year performance comparison analysis helps to discover any potential trend from the 8^{th} to the 12^{th} grade, while the separate analyses for geographical region provide a mechanism for detecting potential regional differences, a necessary measure to address the shortcoming of the NELS:88 measure of school locale.

Method

Data Source

NELS:88 data collection was designed and conducted by the National Center for Education Statistics (NCES, 1994). NELS:88 has followed a nationally representative sample of approximately 24,500 students who were in the 8th grade in 1988. Currently, four waves of data are available: the base year of 1988 (8th grade), the first follow-up of 1990 (10th grade), the second follow-up of 1992 (12th grade), and the third follow-up of 1994 (2 years after high school graduation). The present study used data from the first three waves of data collection (8th- to 12th-grade levels).

Questionnaires were administered to each student, one parent of the student, and two of the student's teachers. Achievement tests in reading, mathematics, science, and social studies were administered to students, which were used as the dependent variables in the analyses described below. For technical details concerning these tests, readers are referred to NCES (1994) and Rock and Pollack (1991).

Two critical features in the NELS:88 data collection pose some special difficulties for data analysis: (a) the effect of purposeful oversampling of some ethnic/linguistic minority groups; and (b) the effect of multi-stage cluster sampling. These two issues are addressed next.

Oversampling. NELS:88 intentionally oversamples some ethnic and linguistic minority groups to provide stable estimates for these populations. Such purposeful oversampling creates problems for data analyses, because the sample is not actually representative of the general population. NELS:88 data are weighted by NCES to reflect the fact that each individual sample member in NELS:88 represents a differential proportion of the national student population. In data analyses for this proposed project, the weights were identified and applied according to NCES guidelines.

Cluster sampling and design effect. A more difficult sampling issue about NELS:88 data is the effect of multistage cluster sampling on the standard errors of sample statistics. Cluster sampling offers many practical advantages (Scheaffer, Mendenhall, & Ott, 1990), but it also poses many challenges for subsequent data analyses. All general statistical programs (e.g., SAS, SPSS, SYSTAT) assume that the data are collected from a simple random sampling design. The cluster sampling design of NELS:88[1] violates this assumption and tends to increase the sampling variance of a statistic (Kish, 1965; Kott, 1991; Lee, Forthofer, & Lorimor, 1989; NCES, 1994). The effect of such increased variance is measured by a quantity called *design effect*, or *deff* (Kish, 1965), the ratio of the actual variance estimate of a cluster sample to the variance estimated based on the assumption of simple random sampling on the same data. When *deff* is ignored in analyses, erroneous decisions in inferential significance testing will result (through inflation of Type I error rate), because a smaller standard error (based on the assumption of simple random sampling) is used when a larger standard error (from the cluster sampling) is called for.

To provide a general guidance for dealing with this issue, the NELS:88 manual provides the estimated values of *deff* for many simple estimators. These estimated *deffs*, though not exhaustive, provide a sound basis for estimating other *deffs* not provided in the manual.[2]

Analyses

Because this study used four outcome variables of school achievement (reading, math, science, and social studies) and three locale groups (rural, suburban, and urban), a multivariate analysis of variance was called for. The three waves of data (1988 for 8th graders, 1990 for 10th graders, and 1992 for 12th graders) were treated separately as three nationally representative samples for 8th, 10th, and 12th graders. Representative samples were produced by assigning the appropriate cross-sectional weights (provided in the NELS:88 database) to each sample member for the three waves in accord with NCES guidelines (NCES, 1994). To take into account the effect of SES on the students' performance, SES was used as the covariate in the analysis. Hence, multivariate analysis of covariance (MANCOVA) became the analytic technique of choice.

Separate analyses were also conducted for students from public and private schools, for students of different ethnic groups, when sample size was adequate, for the four geographical regions.

Because the sample size was large for some analyses in this study, small and practically unimportant differences could be declared statistically significant due to the statistical power contributed by the large sample size. For this reason, multivariate effect size measures were calculated to supplement significance testing. The practice of using effect size measures to supplement significance has increas-

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[1]In NELS:88 data collection, schools formed the natural sampling units, and students were then sampled within schools.

[2]As discussed in the manual of NELS:88, ". . . more complex estimators show smaller design effect than simple estimators. Thus correlation and regression coefficients tend to have smaller design effects than subgroup comparisons, and subgroup comparisons have smaller design effects than means. This implies that it will be conservative to use the mean square root design effects presented here in calculating approximate standard errors for complex statistics, such as multiple regression coefficients" (NCES, 1994, p. 91). In this study, this conservative approach was adopted.

Table 1
8th Grade Rural/Suburban/Urban Students Performance Comparison—Public Schools

Ethnicity	Locality	*N*	Read	Math	Science	Social S.	MANCOVA Results
			Means (Adjusted for SES)				
Asian/ Pacific	Rural	140	51.36[a]	51.66	52.42	50.95	Wilk's Λ = .96*
	Suburban	604	50.73	53.83	51.35	51.65	$R^2 \approx .04$
	Urban	430	49.37	52.98	49.76	49.67	
	ANCOVA	$F =$	3.58	3.11	5.03*	4.43	
	Results	$\eta^2 =$	.005	.004	.007	.006	
Hispanic	Rural	484	44.50	45.15	45.59	44.67	Wilk's Λ = .98*
	Suburban	942	46.41	46.08	46.65	46.05	$R^2 \approx .02$
	Urban	1143	45.05	44.71	44.66	44.55	
	ANCOVA	$F =$	12.51*	8.08*	15.27*	8.27*	
	Results	$\eta^2 =$	.005	.004	.007	.006	
Caucasian	Rural	4757	51.56	51.72	52.40	51.60	Wilk's Λ = .99*
	Suburban	5336	51.00	51.22	51.08	50.90	$R^2 \approx .01$
	Urban	1731	50.63	50.63	50.83	50.59	
	ANCOVA	$F =$	7.30*	9.06*	30.18*	10.40*	
	Results	$\eta^2 =$	.001	.001	.005	.002	
African-American	Rural	593	44.73	43.94	44.77	44.85	Wilk's Λ = .97*
	Suburban	580	44.09	44.06	44.00	45.03	$R^2 \approx .03$
	Urban	1208	44.04	43.11	42.57	44.15	
	ANCOVA	$F =$	1.61	4.97*	20.64*	3.12	
	Results	$\eta^2 =$	.001	.004	.016	.002	

*$p < .01$.
[a]For space consideration, standard deviations are not presented. Even though the scores are on T-score scale (mean of 50, and standard deviation of 10), the standard deviations for the ethnic groups tend to differ, with the three minority groups having somewhat smaller standard deviations (7 to 9), and the majority group (Caucasian) having somewhat larger standard deviation (10 to 11). This phenomenon appears to be consistent across the three grades.

ingly been advocated in recent years (e.g., Shaver, 1993; Thompson, 1996). In this study, the multivariate effect size measures were calculated in the form of Wilk's Λ, a measure conceptually related to the widely known R^2 in analysis of variance (ANOVA) or regression analysis (Pedhazur, 1982).[3]

Inevitably, in a large database like NELS:88, a considerable number of subjects would have missing data on some variables used in this study. In our analyses, we did not attempt to substitute for or otherwise impute missing data. Instead, we used only cases with complete data for all the variables involved in the analyses. For this reason, the usable sample sizes were smaller than those in NELS:88. The sample size reduction due to this reason was minor for the 8th graders (base year of 1988 data collection in NELS:88), but was more pronounced for the later waves. In these waves (1990, 10th grades; 1992, 12th graders) fewer students took the achievement tests for a variety of rea-

[3]As Pedhazur (1982, p. 708) shows, $R^2 = 1$ - Wilk's Λ. An R^2 of .02 is usually interpreted as small effect size, an R^2 of .10 as a medium effect size, and an R^2 of .25 a large effect size (e.g., Cohen, 1988).

Table 2
10th Grade Rural/Suburban/Urban Students Performance Comparison—Public Schools

Ethnicity	Locality	N	Read	Math	Science	Social S.	MANCOVA Results
			Means (Adjusted for SES)				
Asian/ Pacific	Rural	114	52.04	53.36	53.98	52.01	Wilk's $\Lambda = .95^*$
	Suburban	424	51.32	54.96	53.00	52.19	$R^2 \approx .05$
	Urban	313	50.38	54.01	50.27	50.12	
	ANCOVA	$F =$	1.59	1.64	9.55*	4.35	
	Results	$\eta^2 =$	.003	.003	.019	.009	
Hispanic	Rural	392	46.08	46.12	46.06	46.04	Wilk's $\Lambda = .98^*$
	Suburban	536	46.63	46.77	46.07	46.52	$R^2 \approx .02$
	Urban	738	46.97	45.76	45.45	46.60	
	ANCOVA	$F =$	1.43	2.43	1.32	.62	
	Results	$\eta^2 =$	.001	.003	.001	.001	
Caucasian	Rural	3962	51.83	52.21	52.65	51.79	Wilk's $\Lambda = .99^*$
	Suburban	4257	51.52	51.80	51.85	51.60	$R^2 \approx .01$
	Urban	1368	52.24	52.21	52.10	51.99	
	ANCOVA	$F =$	3.46	2.43	7.46*	1.10	
	Results	$\eta^2 =$	.001	.000	.001	.000	
African-American	Rural	455	45.04	44.60	43.80	46.06	Wilk's $\Lambda = .97^*$
	Suburban	381	45.02	44.89	43.87	46.48	$R^2 \approx .03$
	Urban	504	45.66	44.13	42.64	45.15	
	ANCOVA	$F =$	.88	1.17	4.50	3.66	
	Results	$\eta^2 =$	.001	.002	.006	.005	

$^*p < .01$.

sons, including early graduation, dropping out of school, and nonresponse on cognitive tests (J. Owings, personal communication, September 12, 1996).

Results and Discussions

Rural/Suburban/Urban Comparison for Public School Students

Tables 1 to 3 present comparisons among rural, suburban, and urban students in the four areas of school learning for the 8th, 10th, and 12th grade levels, respectively by the four major ethnic groups. For each ethnic group, three important pieces of information are provided: (a) the MANCOVA results; (b) the ANCOVA results; and (c) the means adjusted for SES of the dependent variables (for each cell).

A close look at Table 1 reveals several phenomena. First, different ethnic groups tend to exhibit different population distribution patterns in rural/suburban/urban areas. While the majority of Caucasian students resided in suburban or rural areas, the majority of African-American and Hispanic students were from urban areas. Second, although the MANCOVA tests are statistically significant for all four ethnic groups for the 8th graders, indicating that there are statistically significant differences among the rural/suburban/urban students when the four outcome variables were considered jointly, the multivariate effect size measures are all extremely small.

Third, the ANCOVA results were statistically significant for some dependent variables of some ethnic groups,

Table 3
12th Grade Rural/Suburban/Urban Students Performance Comparison—Public Schools

Ethnicity	Locality	N	Means (Adjusted for SES) Read	Math	Science	Social S.	MANCOVA Results
Asian/ Pacific	Rural	102	51.12	52.65	51.27	51.55	Wilk's $\Lambda = .97^*$
	Suburban	391	51.46	55.03	51.99	52.64	$R^2 \approx .03$
	Urban	257	51.06	53.87	50.85	50.40	
	ANCOVA	$F =$	.16	3.35	1.29	4.54	
	Results	$\eta^2 =$	.000	.007	.002	.010	
Hispanic	Rural	317	46.40	46.15	46.34	45.97	Wilk's $\Lambda = .98^*$
	Suburban	451	46.81	46.74	46.11	46.80	$R^2 \approx .02$
	Urban	560	47.81	47.83	46.37	47.80	
	ANCOVA	$F =$	2.90	4.43	.12	4.37	
	Results	$\eta^2 =$	.004	.005	.000	.006	
Caucasian	Rural	3259	51.83	52.53	52.78	52.08	Wilk's $\Lambda = .99^*$
	Suburban	3227	51.95	52.34	52.66	52.09	$R^2 \approx .01$
	Urban	1078	52.73	52.50	52.26	52.47	
	ANCOVA	$F =$	4.18	.42	1.40	.85	
	Results	$\eta^2 =$	.001	.000	.000	.000	
African-American	Rural	373	44.84	44.95	43.87	46.01	Wilk's $\Lambda = .97^*$
	Suburban	287	44.87	44.61	42.86	45.90	$R^2 \approx .03$
	Urban	385	45.75	44.37	42.74	45.17	
	ANCOVA	$F =$	1.37	.45	1.94	1.10	
	Results	$\eta^2 =$	.002	.001	.003	.002	

$^*p < .01$.

but the ANCOVA effect-size measures (eta-squares, η^2) are all too small to indicate practical significance. Fourth, while the differences by locale are quite small, differences among ethnic groups are more pronounced, with Caucasian and Asian groups performing better than African-American and Hispanic groups, regardless of locality. Because the purpose of these analyses was to avoid the potential confounding of ethnicity with differences by locale, further analysis of ethnical differences in achievement is beyond the scope of the present study.

Finally, the adjusted means of the four dependent variables are comparable across locale groups. There is, in short, no systematic evidence in Table 1 that rural students performed worse than their metropolitan counterparts, or vice versa. Rural/suburban/urban differences are almost nonexistent for this nationally representative sample of 8th graders.

Table 2 and Table 3 convey similar information: the MANCOVA tests are all statistically significant, but the multivariate effect size measures are extremely small. Unlike Table 1, however, the univariate ANCOVA tests on the individual dependent variables for locale groups rarely reached statistical significance level. In fact, for the 12th graders measured in 1992 (Table 3), none of the ANCOVA tests for differences by locale is statistically significant, despite the huge sample sizes for some ethnic groups (e.g., for Caucasian group). The fact that the multivariate tests are statistically significant while the univariate tests are not is a well-known statistical phenomenon: multivariate tests are usually more powerful than univariate tests (Stevens, 1996). Multivariate significance and univariate nonsignificance do not constitute contradictory evidence in this case, where practical significance is negligible.

Table 4
8th, 10th, and 12th Grade Caucasian Rural/Suburban/Urban Students Performance Comparison—Private Schools

Grade	Locality	N	Read	Math	Science	Social S.	MANCOVA Results
			Means (Adjusted for SES)				
8th Grade	Rural	321	55.26	55.53	54.21	55.30	Wilk's $\Lambda = .99^*$
	Suburban	1606	55.69	54.72	54.51	55.85	$R^2 \approx .01$
	Urban	1903	55.89	55.28	54.26	55.50	
	ANCOVA	$F =$	.78	2.32	.38	1.00	
	Results	$\eta^2 =$	.000	.001	.000	.000	
10th Grade	Rural	87	57.22	55.85	54.28	54.45	Wilk's $\Lambda = .98^*$
	Suburban	560	56.93	56.99	56.67	56.51	$R^2 \approx .02$
	Urban	1177	56.96	56.84	55.85	56.34	
	ANCOVA	$F =$	.06	1.02	4.14	3.03	
	Results	$\eta^2 =$	.000	.000	.004	.003	
12th Grade	Rural	82	56.17	56.86	55.62	55.77	Wilk's $\Lambda = .98^*$
	Suburban	418	55.48	57.42	56.37	55.68	$R^2 \approx .02$
	Urban	955	56.63	57.09	55.81	56.77	
	ANCOVA	$F =$	2.65	.37	.69	2.44	
	Results	$\eta^2 =$	.003	.000	.001	.003	

$^*p < .01$.

Comparison by Locale for Private School Students

Table 4 presents comparisons by locale on the four dependent variables for the students in private schools. Because there were only a few, or even no, usable sample members from rural private schools for the three grades, comparisons between rural and metropolitan private school students for three minority groups were almost impossible. Hence, the analysis by locale is presented only for Caucasian students enrolled in private schools.

A comparison of Table 4 with the previous Tables 1 to 3 shows that, for the Caucasian group, the students from private schools performed better than those from the public schools, regardless of the school locality and grade. Again, because our interest is not comparisons between private and public school students per se, and we conducted separate analyses for public and private school students only to avoid the potentially confounding influence of this variable on comparisons by locale, we made no further efforts to examine sector differences in student achievement.

The information from Table 4 about private schools is consistent with that from the previous three tables about public schools: although the MANCOVA tests are statistically significant, all the multivariate effect size measures are extremely small. Furthermore, none of the univariate ANCOVA tests is statistically significant despite the large sample sizes. The univariate effect-size measures for differences by locale are all close to zero. Again, the results here indicate no differences by locale for private school students.

Comparison by Locale in Different Geographical Regions

Division of data into four regions, in addition to division by sector and ethnicity, caused such a reduction of sample size in some cells, especially among rural students, that reliable comparisons among locale groups became questionable. For this reason, as well as for consideration of space, we present regional comparisons by locale only for Caucasian students (the group with adequate sample sizes under all conditions).[4]

[4]The tables for other ethnic groups are available upon request.

Table 5
8th Grade Rural/Suburban/Urban Performance Comparison—Public School Caucasian Students in Four Geographical Regions

Geographic Region	Locality	N	Means (Adjusted for SES)				MANCOVA Results
			Read	Math	Science	Social S.	
Northeast	Rural	673	52.68	52.61	53.90	53.30	Wilk's $\Lambda = .98^*$
	Suburban	1250	52.01	52.72	52.18	52.27	$R^2 \approx .02$
	Urban	216	51.77	51.15	52.49	52.94	
	ANCOVA	$F =$	1.30	2.66	6.59*	2.61	
	Results	$\eta^2 =$	.001	.002	.005	.002	
Mid-West	Rural	1639	52.14	53.24	53.27	52.26	Wilk's $\Lambda = .97^*$
	Suburban	1651	50.34	50.81	50.65	50.41	$R^2 \approx .03$
	Urban	423	49.96	51.39	50.44	50.55	
	ANCOVA	$F =$	18.81*	31.37*	37.22*	18.65*	
	Results	$\eta^2 =$	.009	.014	.017	.009	
South	Rural	1864	50.38	49.83	50.91	50.14	Wilk's $\Lambda = .99$
	Suburban	1325	50.63	49.91	50.51	50.10	$R^2 \approx .01$
	Urban	732	49.97	49.54	50.11	49.92	
	ANCOVA	$F =$	1.17	.41	2.05	.14	
	Results	$\eta^2 =$	.001	.000	.001	.000	
West	Rural	581	51.48	51.42	52.11	51.51	Wilk's $\Lambda = .99^*$
	Suburban	1110	51.57	52.09	51.46	51.31	$R^2 \approx .01$
	Urban	342	51.75	51.75	51.31	50.33	
	ANCOVA	$F =$	.09	.93	1.05	1.93	
	Results	$\eta^2 =$	.000	.001	.001	.002	

$^*p < .01$.

Tables 5 to 7 present comparisons by locale in the four geographical regions for 8th, 10th, and 12th graders, respectively.

Close examination of Table 5 shows that for Caucasian students in public schools, differences by locale on the achievement variables do not seem to exist in the South, West, and Northeast. In these three regions, although the MANCOVA tests are statistically significant, almost all univariate ANCOVA tests fail to reach statistical significance, despite the large sample sizes. Also, the univariate effect size measures (η^2) are close to zero.

In the Midwest region, however, the data appear to favor the students from rural public, with all the univariate ANCOVA tests statistically significant at the .01 level. The magnitude of difference is roughly one fifth of a standard deviation on the dependent measures. The effect-size measures (η^2), although still relatively small, are conspicuously larger than those for the other three regions.

The slight advantage in favor of the 8th grade students from the rural schools in the Midwest region (Table 5) seems to be less obvious and less consistent for the 10th graders in Table 6. In Table 6, other than for the Midwest region, practically no differences by locale appear to exist; all the univariate ANCOVA tests are statistically nonsignificant, and the univariate effect-size measures are close to zero. The results in Table 7 are less clear for interpretation. In some cases, the 12th graders in rural schools appear to have a slight edge (e.g., Midwest, for math and science);

Table 6
10^{th} Grade Rural/Suburban/Urban Performance Comparison—Public School Caucasian Students in Four Geographical Regions

Geographic Region	Locality	*N*	Means (Adjusted for SES) Read	Math	Science	Social S.	MANCOVA Results
Northeast	Rural	596	53.19	53.45	54.20	54.12	Wilk's $\Lambda = .98^*$
	Suburban	1062	52.73	53.73	53.56	54.02	$R^2 \approx .02$
	Urban	165	54.58	53.93	53.05	53.82	
	ANCOVA	$F =$	3.53	.28	1.39	.08	
	Results	$\eta^2 =$	.003	.000	.001	.000	
Mid-West	Rural	1500	51.91	53.24	53.36	52.22	Wilk's $\Lambda = .97^*$
	Suburban	1448	50.67	51.29	51.51	50.84	$R^2 \approx .03$
	Urban	378	51.58	52.38	51.52	53.31	
	ANCOVA	$F =$	6.92*	18.14*	16.71*	15.09*	
	Results	$\eta^2 =$	.004	.009	.009	.008	
South	Rural	1418	50.76	50.34	50.78	50.27	Wilk's $\Lambda = .99$
	Suburban	1031	50.97	50.23	50.57	50.36	$R^2 \approx .01$
	Urban	540	51.43	51.24	50.98	51.14	
	ANCOVA	$F =$	.93	2.46	.42	1.69	
	Results	$\eta^2 =$	.001	.001	.000	.001	
West	Rural	448	52.51	52.34	53.39	51.42	Wilk's $\Lambda = .98^*$
	Suburban	716	52.59	52.76	52.41	51.76	$R^2 \approx .02$
	Urban	285	53.16	53.01	54.16	51.29	
	ANCOVA	$F =$	.55	.49	4.32	.36	
	Results	$\eta^2 =$	.001	.001	.001	.000	

$^*p < .01$.

but in other cases, the data appear to favor the urban 12^{th} graders (e.g., South, for reading and math). Despite these anomalies, the general conclusion based on the data in Table 7 is that there is no consistent evidence pointing to noticeable or systematic differences by locale.

The results by geographical regions accord with the previous analyses: when the data are analyzed separately for ethnic groups, separately for public and private school students, and separately for geographical regions, and when school achievement is adjusted for SES, achievement differences by locale do not exist among nationally representative samples of 8^{th}, 10^{th}, and 12^{th} grade students. In the few instance where slight differences of practical importance are observed, results are inconsistent.

Summary and Conclusions

This study conducted analyses to examine the issue of whether any rural/suburban/urban differences by locale exist in students' academic achievement. The study relied on data from the National Education Longitudinal Study of 1988, a multi-year database from a large and nationally representative sample of students as they progressed from the 8^{th} to 12^{th} grade. Performance comparisons among rural, suburban, and urban students were made for samples of the 8^{th}, 10^{th}, and 12^{th} graders in four areas of school learning: reading, math, science, and social studies, adjusting for SES. Comparison analyses were conducted separately for four major ethnic groups, for public and private school students, and for four geographical regions of the United States.

Table 7
12th Grade Rural/Suburban/Urban Performance Comparison —Public School Caucasian Students in Four Geographical Regions

Geographic Region	Locality	*N*	Means (Adjusted for SES) Read	Math	Science	Social S.	MANCOVA Results
Northeast	Rural	515	53.15	54.53	55.21	53.38	Wilk's Λ = .98*
	Suburban	845	52.53	53.76	53.19	52.60	R^2≈.02
	Urban	136	53.71	54.40	53.33	53.56	
	ANCOVA	F =	1.62	1.12	8.54*	1.67	
	Results	η^2 =	.002	.001	.010	.002	
Mid-West	Rural	1254	51.80	53.40	53.18	52.72	Wilk's Λ = .98*
	Suburban	1092	51.29	51.64	52.22	51.92	R^2≈.02
	Urban	307	52.12	51.67	51.67	52.82	
	ANCOVA	F =	1.43	13.16*	4.91*	2.63	
	Results	η^2 =	.001	.009	.003	.002	
South	Rural	1154	50.75	50.67	50.92	50.31	Wilk's Λ = .99*
	Suburban	755	51.25	51.29	51.89	51.25	R^2≈.01
	Urban	415	52.62	52.33	51.80	51.60	
	ANCOVA	F =	5.77*	5.35*	3.06	3.89	
	Results	η^2 =	.005	.004	.002	.003	
West	Rural	336	52.96	51.95	53.15	53.11	Wilk's Λ = .99
	Suburban	535	53.76	53.45	54.21	53.30	R^2≈.01
	Urban	220	53.38	52.94	53.40	53.17	
	ANCOVA	F =	.83	2.85	1.62	.05	
	Results	η^2 =	.001	.004	.003	.000	

*$p < .01$.

We find that students from rural schools perform as well as their peers in metropolitan areas in the four areas of school learning: reading, math, science, and social studies. The results from this study confirm findings of some previous studies (e.g., Haller et al., 1993; Snyder & West, 1992). These results do not support the conjecture that students in rural schools nationwide are at a general disadvantage in terms of the quality of their education, at least as reflected in their performance on a standardized achievement test. It should be pointed out, however, that this study did not provide any direct evidence that the deficit model of rural education or rural lifeways is correct or incorrect. The results simply show that one important outcome predicted by this model is not evident at the national level.

The findings of this study were based on data collected nationally, and the samples used in this study are nationally representative within known limits. These conditions increase generalizability and the overall credibility of the findings. The analyses for separate ethnic groups, for the public and private school students, and for regions help mitigate confounding influences as reasoned in the previous sections. These features help to strengthen the internal and external validity of the study.

This study also has its share of limitations. First, although the definition and classification of school locality (rural, suburban, and urban) are based on the criterion used in the U.S. Census, the data did not allow us to examine those rural schools from "extreme rural communities," as did some previous studies (e.g., Easton & Ellerbruch, 1985).

It is possible that students from these "extreme rural communities" may have deficiencies or differences in their school learning (Khattri et al., 1997; Williams, 1996) that would otherwise be more obvious. In the same vein, the data did not allow comparisons with students from the "disadvantaged-urban" schools, usually inner city schools, the other end of the locale spectrum (Easton & Ellerbruch, 1985). Second, although the data for the 8th graders were quite complete for the variables used in this study, there were missing data in subsequent NELS:88 waves, especially on the four cognitive tests (reading, math, science, and social studies). The missing data may have made the data for the 10th and 12th graders less representative of the general student population. Although the extent to which the problem of missing data may have distorted the results is unknown, in our opinion, such distortion, if any, is probably small, since the findings across these analyses are remarkably consistent.

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