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ABSTRACT

This paper examines differences in educational outcomes among 1,792 students from small (fewer than 300 pupils), average (400-700 pupils), and large (900-1,200 pupils) rural high schools, and among 1,084 students from small high schools in urban, suburban, and rural settings. Data were drawn from the High School and Beyond database, a national sample of high school students surveyed four times from 1980-86. In the rural schools, socioeconomic status (SES) explained between 10-20% of the variability in all of the dependent measures except two; gender explained as much variance in the writing measure as SES; and school size was not significantly related to any dependent variable. Once socioeconomic status was controlled, urbanicity produced only negligible differences in academic outcomes. School size produced nonsignificant but consistent differences in educational outcomes. In all cases except the mathematics measure, students from small schools had higher mean scores on the dependent measures than other students, and students from moderately sized schools had higher mean scores than those from large schools. This report contains 15 references and 6 data tables. (SV)

Academic Achievement in America's Small Schools: Data From High School and Beyond

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Consolidation of small, rural schools and districts has been one of the most actively and successfully implemented educational policies of the twentieth century. Virtually all rural districts have been through at least one or more rounds of consolidation efforts. The conventional wisdom of mid-century educational policymakers was that bigger was better and more economical. Some of the most common rationalizations for closing small schools was that students in a single large school could be better served by more specialized teachers and more up-to-date materials,and more and better equipment and facilities could be provided for the students and staff. The realities of consolidation have often not lived up to expectations of the policymakers or rural communities. Larger schools have not always proved to be as economical as expected, and the quality of education, often, has not improved to the extent predicted by advocates of consolidation (Sher and Tompkins, 1976).

It is difficult to separate the issues of expenditures and efficiency from any discussion of schools, especially rural schools. The drive for economically efficient rural school systems led the move for consolidation. Policymakers argued that by pooling resources, students in rural communities would be offered comprehensive educational programs unaffordable to smaller districts. It was also said that, a larger percentage of the budget could be spent on educational programs instead of building overhead and administrative costs (Sher, 1981). An unfortunate characteristic of rural communities is that they tend to be the poorest community type (Sher, 1981). Over 14 million people rural U.S. citizens live in poverty (Nachtigal, 1982). As most educators know, this single characteristic can have a tremendous impact on an educational system and the students' it serves. It is easy to see why consolidation supporters were able to convince rural communities to reorganize; the promise of a better (i.e. more expensive) education for their children was too attractive an offer to refuse.

A review of consolidation literature noted that ranges of 293 to 2,000 pupils were reported as optimum sizes for high school cost effectiveness. However, the same paper suggested that an optimum cost-effective size for high schools ranged between 1500-1800 pupils (ERIC, 1982). But, because of the diversity of rural communities, measures of central tendency are practically useless. Sher and Tompkins (1976) reviewed the existing literature related to school and district consolidation and concluded that while there might be some financial benefits to consolidation, claims of fiscal efficiency had been greatly exaggerated by proponents of reorganization.

Most of the studies of the effects of school and district reorganization have concentrated on financial matters; the academic results of consolidation have only recently come under scrutiny. Although policymakers promised improved academic performance as an outcome of consolidation, but in a review of 14 major studies, Sher and Tompkins (1976 p.26) reported, "In fact, of the recent, controlled studies, there is not a single one which records a consistent, positive correlation between size and achievement, independent of IQ and social class." Unfortunately, it is unclear if these studies produced consistent negative relationships between achievement and school size.

Several studies have investigated the relationship between school and/or district size and student achievement (Barker and Gump, 1964; Kiesling, 1968; Eberts, et al., 1984, Walberg and Fowler, 1987) while either experimentally or statistically controlling for important mediating variables such as socioeconomic status (SES), ability, and per pupil expenditures. The positive relationship between SES and achievement has been well documented in the educational and psychological literature (White, 1982; Shanahan and Walberg, 1985; Walberg and Fowler, 1987; Coladarci and McIntire, 1988). White's extensive review (1982)

reported that almost all of the 620 correlations yielded by the 200 studies analyzed produced positive associations with academic achievement. Walberg and Fowler (1987) reported a "strong, consistent positive relationship between SES and achievement" in their analysis of over 500 New Jersey school districts, and in a study comparing the ability and achievement levels of rural, suburban, and urban high school students from a national data base, Coladarci and McIntire (1988) reported that SES accounted for the major proportion of variance in three measures of ability and three measures of achievement.

Eberts, et al. (1984) and Walberg and Fowler (1987) reported negative associations between school size and student achievement , and in Ebert's study the negative correlation was much greater when comparing moderate (400-599 pupils/school) to large (over 800 pupils/school) schools, than when comparing small (less than 200 pupils/school) to moderately sized schools. Neither of these studies focused on rural areas, but as Sher (1981) suggested, important influential factors such as SES tend to have much greater impacts on achievement than where the school is located.

The need for empirical research examining the academic effects of consolidation and other important rural education issues has been the subject of several recent reviews (Helge, 1986; DeYoung, 1987; Swanson, 1988). Helge (1986) performed a cluster analysis with data from a national survey of rural educators to establish an empirically determined national rural education research agenda. She reported that rural school effectiveness emerged as the top cluster. Results of a poll of the research and executive committees of the Rural Education Association in 1983 noted that of the nine most pressing needs for rural education research, rural school effectiveness was judged to be the most important (cited in DeYoung, 1987).

DeYoung's (1987) extensive literature review stressed the need for better empirical data base studies to help researchers and policy makers begin to understand the nature of rural education. Coladarci and McIntire (1988) used a nationally representative data base to begin to explore some of the issues of rural school effectiveness. While they found few differences as a result of school setting, they suggested that future research examine the differences among rural schools and try to identify the school-level characteristics that account for these differences. Sher (1981) had also suggested that only comparing rural and urban differences is inappropriate and misleading; examining different types of schools within the same setting would prove to be more productive.

The major purpose of this paper was to examine the differences, while controlling for SES, in educational outcomes for students from small, average, and large rural schools. Small school outcomes were also compared across context (urban, suburban, and rural) with SES controlled. The contribution of gender to academic outcomes was also investigated.

Method

The Data Set

We employed the sophomore sub-sample of the High School and Beyond (HSB) data base, a nationally representative sample of high school students in 1980, most of whom were surveyed again in 1982, 1984, and 1986 (National Opinion Research Center 1987). In the 1980 cohort, students were selected through a two-stage, stratified probability sample with schools as the first stage sampling units and students as the second stage. There were 1015 schools selected for the sample, and 36 seniors and 36 sophomores were randomly selected within each school. In those schools with fewer than 36 seniors and/or sophomores, all eligible students were included in the sample. The subjects in our study were drawn from those students participating in all four waves of the survey. There were 13425 students participating in all four waves of this survey, of which 3141 were from rural CIC census regions. All analyses were conducted with modified HSB sampling weights in effect. Certain groups were over-sampled during the 1980 base-year survey and due to the non-random nature of the follow-up surveys, the National Center for Educational Statistics suggests that whenever inferential statistics and tests of significance are performed using HSB data, the weighting procedure should be employed (National Opinion Research Center, chap. 3, 1987). In order to preserve an accurate, but proportionally correct, sample size, the weight was divided by a mean weight to produce the weighting measure used in this study.

Subjects

In the first analysis comparing small schools (fewer than 300 students) across contexts, 138 students (12.8%) were from urban high schools, 266 (24.6%) were from suburban high schools, and 680 (62.7%) were from rural schools. Of the students used in this weighted analysis, 518 (47.8%) were male and 566 (52.2%) were female.

In the second analysis, comparing schools within rural regions, 535 (29.9%) were from small (fewer than 300 students) high schools, 729 (40.7%) students were from average (400-700 pupils) size school, and 528 (29.5%) students were from large (900-1200 students) high schools. In this sample 895 (49.9%) were females and 897 (50.1%) were male. Eberts, et al. (1984) found a strong negative relationship between achievement and school size as size moved from 400 students per school to over 800. Others (Sher, 1981; Walberg and Fowler, 1987; DeYoung, 1987; Swanson, 1988) have also suggested that there is a strong decline in educational effectiveness at the higher levels of school and district size. We decided to restrict our analysis to schools of 1200 students or less because if schools with fewer than 300 students were reorganized, it is unlikely that the resulting schools would be much larger than 1200 students.

Variables

SPSSX statistical software (SPSS, 1988) was used to carry out both the descriptive and inferential statistical procedures. The variables were drawn directly from the HSB data. Socioeconomic status is a HSB-created composite based on five components: 1) father's occupation, 2) father's education, 3) mother's education 4) family income, and 5) material possessions in the household (i.e. personal calculator, 50 or more books, place to study, etc.). The socioeconomic composite is the simple average of the non-missing components from the 1980 survey, after each of the five scores has been standardized.

The six achievement variables from the 1980 survey were the percent correct on a 21-item vocabulary test, a 19-item reading test, a 20-item science test, a 17-item writing test, a 10-item civics test, and the average score of the 28-item and 10-item math tests. For a more detailed discussion of these tests see Heyns and Hilton (1982).

The educational aspirations variable was taken from a single 1982 item "As things stand now, how far in school do you think you will get?", with choices ranging from "less than high school graduation" to "Ph.D., M.D., or other advanced professional degree".

The educational attainment variable was drawn from the 1986 survey and reflects the highest level of education achieved by the respondent. Choices are similar to those for the educational aspirations variable described above.

Results

Means, standard deviations, ranges, and intercorrelations are reported in Tables 1 and 4. In both cases, high positive correlations (r=.48 to .70) were found among the six achievement variables. The intercorrelations among SES, aspirations, and educational attainment were positive and fairly strong (r=.25 to .46) in both samples, and the correlations among each of these three variables with the achievement measures were consistently positive (r=.23 to .51).

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Insert Table 1 about here

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Coladarci and McIntire (1988) suggested that with large sample sizes, merely examining the statistical significance of the explained variance is inappropriate. Rather, they suggest that the Sum of Squares associated with each source (covariate, main effects, and interaction) be reported as a proportion of the total Sum of Squares. This issue is easily observed in Tables 2 and 5; it was statistically significant (alpha=0.05) if only 0.01% of the variance in the dependent measures was explained by the covariate or one of the main effects, but this could hardly be considered substantively significant. Using this method of reporting findings, the results of our analysis are presented below.

The Relationship of Context, Gender, and SES to Educational Outcomes in Small Schools

The relative contributions of SES, context, and gender for explaining variability in the performance of students from small schools on eight dependent measures were assessed. A three (context) by two (gender) analysis of covariance with SES as the covariate was conducted (see Table 2).

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Insert Table 2 about here

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Socioeconomic status (SES) explained far more variance in the dependent measures than either of the main effects (context or gender) or the interaction term (context X gender). As can be seen in Table 2, SES explained between 10 and 20% of the variability in all of the dependent measures except Civics and Educational Attainment, where approximately 6.5% of the variance was explained by SES. Writing was the only dependent measure where one of the main effects (gender) explained a noticeable amount of variability. In all other cases, context, gender, or the interaction of context and gender explained little to no variability in the dependent measures.

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Insert Table 3 about here

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Table 3 further illustrates the negligible influence of the main effects upon the dependent measures with SES controlled. There were only minor differences in the educational outcomes among students from small schools as a result of the school setting. Gender differences in small schools were minor, except on the writing and science measures. Females scored on the average over 12% higher on the writing measures, while the mean score for males was 3% higher on the science test. Females in small schools had approximately 8% higher levels of educational aspirations.

The Relationship of School Size, Gender, and SES to Educational Outcomes in Rural Schools

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Insert Table 4 about here

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The relative contributions of SES, school size, and gender to the explanation of educational outcomes of students in rural schools on eight dependent measures were calculated using a three (school size) by two (gender) analysis of covariance with SES as the covariate (see Table 5).

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Insert Table 5 about here

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Socioeconomic status (SES) explained far more variance in the dependent measures than either of the main effect (school size or gender) or the interaction term (school size X gender). SES explained between 10 and 17% of the variability in all of the dependent measures except Civics and Educational Attainment, where approximately 5.5% of the variance was explained by SES. Writing was the only dependent measure where one of the main effects (gender) explained as much variability as SES. In all other cases, context, gender, or the interaction of context and gender explained little to no variability in the dependent measures.

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Insert Table 6 about here

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The mean scores of the dependent variables after they have been adjusted for SES and the other main effect are presented in Table 6. . Gender differences in small schools were minor, except on the writing and science measures. Females scored on the average over 15% higher on the writing measures, while the mean score for males was approximately 2.5% higher on the science test. Females in rural schools had approximately 10% higher levels of educational aspirations. There were minor, but consistent, differences in the educational outcomes among students from rural schools of various sizes. In all cases, except for Math, students from small

(less than 300 students) high schools had higher mean scores on the dependent measures than students from the moderately sized (400-700 students) schools, or the large (900-1200 students) schools, and students from moderately sized high schools had higher or equivalent mean scores than students from large schools on all of the dependent variables. While these differences were small, the consistency of the pattern is striking.

Conclusions

Our analyses continue to illustrate the importance of the relationship of socioeconomic status to educational outcomes. SES accounted for considerably more variance in student performance than did either of the main effects or the interaction terms on the eight dependent measures used in our study. The results of our analysis of student achievement in small schools across context substantiated the results reported by Coladarci and McIntire (1988). In these contextual analyses, the unadjusted scores generally favor the higher SES urban and suburban schools, but in both studies, once SES was controlled, negligible differences in academic outcomes due to urbanicity were found. It would be fruitful to use the High School and Beyond Data Base in future research to examine school-level differences within urban and suburban contexts as well.

The minor effect of gender in our analyses supports the conclusions of much of the recent research relative to gender differences in academic outcomes (Chipman, 1988; Coladarci and McIntire, 1988; Marion, 1988). The large gender difference on the writing scores though, is deserving of further attention.

- The results of this study point out some interesting differences among rural schools of various sizes, corroborating the general findings previously reported (Eberts, et.al, 1987; Walberg and Fowler, 1987). As in Ebert's(1984) study, the differences between moderate and large schools were larger than those between small and moderately sized schools. Unlike these results, Walberg and Fowler (1987) reported that district size accounted for a significant amount of variance in student achievement. One explanation for this difference is that district size in their study ranged from a low of 36 to a high of 56,294 students, whereas our study investigated only schools with fewer than 1200 students. The greater variability in school and/or district size in Walberg and Fowler's (1987) study increased the possibility of statistically significant results, with all other factors being similar.

Kiesling (1968) also reported a negative relationship between school size and achievement with SES, ability, and expenditures controlled, but without any controls he found that achievement increased up to approximately 1400 pupils per school. In our preliminary investigations, we found a slight positive correlation ($r=0.04$) between SES and school size, but students from smaller schools in our sample still had higher unadjusted mean scores on almost all of the achievement measures. We considered using ability (vocabulary scores in this case) as a covariate, but the correlation between vocabulary and school size was so low ($r= -0.002$), that its use as a covariate would be pointless.

Several educational researchers and supporters (notably Barker, Sher, and Nachtigal) feel that the benefits of small schools, once understood and appreciated, may provide models for educational excellence (DeYoung, 1987). The use of large-scale empirical data bases, like High School and Beyond, will help policymakers begin to understand small, rural schools and will help educational researchers develop working notions for future research.

There appears to be a policy shift taking place, largely as a result of public pressure, to support rural education initiatives. The reasons are varied, but there appears to be increasing dissatisfaction with consolidation policies, a renewed respect for rural models, and pressure for educational equality (Sher, 1981a). The traditional rural school is increasingly viewed as a primary source of community pride and identity. The family-like environment found in most small, rural schools is unique and something to be cherished. Small schools are integral parts of the communities they serve and are believed to enhance students' feelings of self-worth and civic pride. To describe only the instructional side of a small school does not do it justice, for much of what makes rural schools special is what happens outside the classroom. Future research to help identify and explain the effects of these less tangible characteristics of small schools is clearly needed.

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TABLE 1

Means, Standard Deviations, and Intercorrelations. Comparison of small schools across context.

Variables	Mean	SD	Range	Correlation Coefficients (a)							
				1	2	3	4	5	6	7	8
1. SES	-0.1	0.8	4.4								
2. Ed. Attainment	2.3	1.0	4.0	.2549							
3. Vocabulary	51.8	21.4	95.2	.4416	.3194						
4. Reading	49.2	20.5	100.0	.3539	.2805	.7000					
5. Math	47.1	18.4	90.0	.3695	.3305	.5886	.6254				
6. Science	55.7	18.6	95.0	.3813	.2826	.6448	.6910	.5928			
7. Writing	62.5	23.6	94.1	.3299	.2690	.5852	.6573	.6237	.5801		
8. Civics	58.3	20.1	100.0	.2563	.2922	.5682	.5910	.4785	.5616	.5503	
9. Ed. Aspirations	4.0	1.6	6.0	.4580	.3558	.4759	.4403	.5062	.3794	.4496	.3634

(a) All correlation coefficients are statistically significant (alpha=0.05).

TABLE 2

Percent of Total Sum of Squares Accounted for by SES, Context, Gender, and the Interaction of Context and Gender.

Variable	SES	Main Effects		Interaction
		Context	Gender	Context X Gender
Math	13.65	0.00	0.00	0.01
Vocabulary	19.50	0.00	0.00	0.01
Reading	12.52	0.00	0.00	0.01
Writing	10.88	0.00	7.40	1.10
Science	14.54	0.01	0.01	0.01
Civics	6.57	0.00	0.00	0.01
Ed. Attainment	6.50	0.00	0.00	0.00
Ed. Aspirations	20.98	1.29	1.06	0.00

Note: All percents greater than or equal to 0.01 are statistically significant (alpha=0.05)

TABLE 3

Adjusted Means for High Schools with less than 300 students.

Variable	Urban	Suburban	Rural	Male	Female
Math	46.81	47.60	47.38	47.27	47.27
Vocabulary	54.62	52.56	51.31	51.86	51.87
Reading	49.87	48.23	49.87	49.29	49.63
Writing	64.63	61.31	63.10	56.13	68.98
Science	53.48	54.03	57.10	57.55	54.54
Civics	59.80	57.26	58.89	58.58	59.51
Ed. Attainment	2.19	2.41	2.34	2.28	2.40
Ed. Aspirations	4.40	4.15	3.90	3.86	4.18

Note: Each mean is adjusted for SES and the other main effect.

TABLE 4

Means, Standard Deviations, and Intercorrelations. Comparison of different sized rural schools.

	Variable	Mean	SD	Range	Correlation Coefficients (a)							
					1	2	3	4	5	6	7	8
1.	SES	-0.2	0.7	4.2								
2.	Ed. Attainment	2.3	1.0	4.0	.2260							
3.	Vocabulary	49.3	20.0	100.0	.3924	.2465						
4.	Reading	47.5	20.2	100.0	.3594	.2383	.6755					
5.	Math	46.3	18.3	94.6	.3833	.3259	.5776	.6300				
6.	Science	55.2	18.5	100.0	.3756	.2542	.6433	.6684	.6171			
7.	Writing	60.0	23.1	94.1	.3244	.2467	.6026	.6365	.6082	.5964		
8.	Civics	57.0	20.6	100.0	.2407	.2228	.5404	.5547	.4834	.5456	.5674	
9.	Ed. Aspirations	4.7	2.4	4.0	.4167	.3682	.4133	.4527	.4724	.3990	.4502	.3692

(a) All correlation coefficients are statistically significant (alpha=0.05)

TABLE 5

Percent of Total Sum of Squares Accounted for by SES, School Size, Gender, and the Interaction of School Size and Gender.

Variable	SES	Main Effects		Interaction
		School Size	Gender	School Size X Gender
Math	14.69	0.00	0.00	0.00
Vocabulary	15.40	0.00	0.00	0.00
Reading	12.92	0.00	0.00	0.00
Writing	10.53	0.00	10.56	0.00
Science	14.11	0.00	0.01	0.00
Civics	5.79	0.00	1.22	0.00
Ed. Attainment	5.11	0.00	0.00	0.00
Ed. Aspirations	17.36	0.00	1.13	0.00

Note: Percents exceeding 0.01% are statistically significant (alpha=.05).

TABLE 6

Adjusted Means for Three Different Sized Rural High Schools.

Variable	School Size (pupils/High School)				
	LT 300	400-700	900-1200	Male	Female
Math	46.47	46.82	46.57	46.73	46.56
Vocabulary	50.03	49.76	48.97	49.11	50.10
Reading	48.87	48.31	46.16	46.96	48.72
Writing	61.82	60.53	59.32	52.97	67.96
Science	56.12	55.63	54.98	56.83	54.38
Civics	58.13	57.70	56.44	55.18	59.69
Ed. Attainment	2.30	2.31	2.31	2.28	2.34
Ed. Aspirations	4.75	4.72	4.70	4.47	4.97

Note: Each mean is adjusted for SES and the other main effect.